

EXHIBIT DX2

TO DECLARATION OF PETER GOSS IN
SUPPORT OF DEFENDANTS' OPPOSITION
TO PLAINTIFFS' MOTION TO EXCLUDE
THE OPINIONS AND TESTIMONY OF
JOHN ABRAHAM, PH.D.

CONFIDENTIAL - SUBJECT TO PROTECTIVE ORDER

Page 1

1 UNITED STATES DISTRICT COURT

2 DISTRICT OF MINNESOTA

3 - - - - -
4 In Re:

5 Bair Hugger Forced Air Warming

6 Products Liability Litigation
7

8 This Document Relates To:

9 All Actions MDL No. 15-2666 (JNE/FLM)
10 - - - - -
11

12 DEPOSITION OF JOHN P. ABRAHAM, Ph.D.

13 VOLUME I, PAGES 1 - 396

14 JULY 20, 2017
15
16

17 (The following is the deposition of JOHN P.
18 ABRAHAM, Ph.D., taken pursuant to Notice of Taking
19 Deposition, via videotape, at the offices of Ciresi
20 Conlin L.L.P., 225 South 6th Street, Suite 4600, in
21 the City of Minneapolis, State of Minnesota,
22 commencing at approximately 9:26 o'clock a.m., July
23 20, 2017.)
24
25

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1 APPEARANCES:

2 On Behalf of the Plaintiffs:

3 Gabriel Assaad

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19 ALSO PRESENT:

20 Ryan M. Stirewalt, Videographer

21 Nathan Bushnell

22

23

24

25

EXAMINATION INDEX

WITNESS EXAMINED BY PAGE

Dr. Abraham Mr. Assaad 4,353

Mr. Goss 340

EXHIBIT DESCRIPTION PAGE

1 Expert Report, John Abraham, Ph.D. 22

2 CV, John P. Abraham 26

3 Materials Considered 27

4 Subpoena, John Abraham 34

5 3M - University of St. Thomas 40

6 Research Proposal, Oct. 18, 2015

7 Chart, "Job Information at Start of 84

8 Run," Abraham00000002

9 3.1.4 CODE OF PROFESSIONAL CONDUCT, 104

10 Rev. 11/14, 6 pgs.

11 Chart, "Summary of data 2010-011 vs 202

12 2010-026, 3M00075103 to 75104

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1 PROCEEDINGS

2 (Witness sworn.)

3 JOHN P. ABRAHAM, Ph.D.,

4 Called as a witness, being first

5 duly sworn, was examined and

6 testified as follows:

7 EXAMINATION

8 BY MR. ASSAAD:

9 Q. Please state your name for the record.

10 A. John, J-O-H-N, Patrick, P-A-T-R-I-C-K,

11 Abraham, A-B-R-A-H-A-M.

12 Q. Have you ever had your deposition taken

13 before?

14 A. Yes.

15 Q. Approximately how many times?

16 A. Six or seven.

17 Q. Were they all in the capacity of an expert

18 witness?

19 A. Yes.

20 Q. And we'll get to those in a little bit. I'm

21 sure -- You've been through the drill before, but I

22 have to go over a few instructions --

23 (Interruption by the reporter.)

24 Q. You've been through the drill before, but

25 I'm going to go over a few instructions. Fair?

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1 9 Internal Correspondence 3M, From 303

2 Eaton, Endle, Chen, Wagner00000013

3 to 0029

4 10 email string, fowler to wagner, 329

5 10/13/2015, Wagner00000001 to 0003

6 11 Article, Stochastic modeling of 345

7 atomizing spray in a complex swirl

8 injector using large eddy

9 simulation, Apte, et al, 2009

10 12 Article, Large-Eddy Simulation of 345

11 Realistic Gas Turbine Combustors,

12 Moin and Apte, AIAA Journal, 2006

13 13 Article, Forced-air warming and 345

14 ultra-clean ventilation do not mix,

15 McGovern, et al, The Journal of

16 Bone & Joint Surgery, 2011

17 14 Article, Patient Warming Excess 345

18 Heat: The Effects on Orthopedic

19 Operating Room Ventilation

20 Performance, Belani, et al,

21 Anesthesia & Analgesia, 2013

22 15 Exhibit B of Dr. Elghobashi's 349

23 errata sheet, with equation on back

24 of one page

25

Page 5

1 First of all, I'm going to ask you numerous

2 questions today. If you don't understand the question

3 I'm asking, please let me know and I'll do my best to

4 rephrase it. Fair?

5 A. Yes.

6 Q. If you answer the question that I've asked,

7 I will assume that you understood the question. Fair?

8 A. Yes.

9 Q. At any time you want to take a break just

10 please let me know. I just ask that you request a

11 break after you answer a pending question. Fair?

12 A. Yes.

13 Q. Okay. We've met before; correct?

14 A. Yes.

15 Q. We've actually met at the deposition of Dr.

16 Elghobashi; correct?

17 A. That is correct.

18 Q. And actually we had a -- two brief

19 discussions at the hotel that we both stayed at in

20 Irvine, California.

21 A. That is correct.

22 Q. And you agree with me that none of the

23 conversations that we've had had any -- anything to do

24 with the substantive issues in this case.

25 A. I agree.

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<p style="text-align: right;">Page 6</p> <p>1 Q. In fact, you commented on my demeanor during 2 the deposition; correct? 3 A. That is correct. 4 Q. And on my jacket that I'm actually wearing 5 today; correct? 6 A. That is correct. 7 Q. And then we had a brief discussion about 8 your work in global warming. 9 A. That is correct. 10 Q. Okay. 11 MR. GOSS: Are you contributing to global 12 warming? 13 THE WITNESS: Yes. Right now. 14 (Laughter.) 15 Q. And -- And actually we talked about my 16 appreciation for your work in the global warming area; 17 correct? 18 A. That is true. 19 Q. Okay. And it's something you're passionate 20 about. 21 A. That is true. 22 Q. And you publish frequently in the area of 23 global warming or climate change. 24 A. That is true. 25 Q. In fact I was looking at your CV, and within</p>	<p style="text-align: right;">Page 8</p> <p>1 the scientific community -- 2 Actually I don't know of anyone who would 3 disagree that climate change exists. Sitting here now 4 I cannot think of a single person in the scientific 5 community who doubts climate change. 6 Q. But there's some high political figures that 7 disagree that climate change exists. 8 A. I mean, we have to be a little bit careful 9 because I don't think any political figures disagree 10 climate change exists. I think there are some people 11 who disagree that humans are causing current climate 12 change, or that humans are a significant cause of 13 current climate change, but I don't know of anyone who 14 would say climate change doesn't exist. 15 Q. Okay. I think that makes sense. 16 I guess the better question is some people 17 in the -- in the community believe that people don't 18 have a -- a significant impact on climate change. 19 A. Yes. 20 Q. Okay. Would that include people in the 21 scientific community as well, even though it's a very 22 few minority? 23 A. There is a small minority that thinks -- 24 I mean, this is a difficult question and I'm 25 going to work to give you the best answer possible.</p>
<p style="text-align: right;">Page 7</p> <p>1 the first -- I only looked at the first 40 2 publications, and about 25 percent of those are on the 3 issue of global warming or climate change. 4 A. That sounds reasonable. 5 Q. You give talks and presentations with 6 respect to climate change and global warming. 7 A. That is true. 8 Q. And you even have some high-profile debates 9 I've heard online regarding these issues. 10 A. Correct. 11 Q. And my understanding is the reason why you 12 are passionate is because of the impact that global 13 warming or climate change could have on the future of 14 our -- of our world. 15 A. That is true. 16 Q. Okay. And you want to do whatever you can 17 make the world a better place for -- for you and for 18 your family and for the rest of the people in the 19 world. 20 A. Yes. 21 Q. However, I think we could agree, based on 22 the recent events in our country, that some people are 23 in disagreement in the scientific community over 24 whether climate change even exists. 25 A. There is a very small minority of people in</p>	<p style="text-align: right;">Page 9</p> <p>1 There's a very small minority of people in the 2 scientific community who think that while climate 3 change may exist and it's due in part to humans, it 4 isn't going to be bad; or that the solutions may be 5 more costly than the problem. So some of the most 6 high-profile contrarians of the mainstream view 7 acknowledge humans' affect on climate change, but it's 8 an issue of magnitude and severity. 9 Q. Okay. And I take it that you disagree with 10 respect to the people that the solutions would be more 11 costly than the problem. 12 A. I'm not an economist, I'm a climate 13 scientist. My understanding of climate change 14 economics, through reading the literature, tells me 15 that the most reputable climate-change economists are 16 reporting that there will be social and economic costs 17 with respect to future climate change, those costs 18 will get worse as climate change gets worse, and in 19 many cases the solutions are less expensive than the 20 costs. 21 Q. Okay. In any event, given the potential 22 impact of climate change, it is important to pursue 23 good science. 24 A. I agree. 25 Q. And to pursue good science you want a solid</p>

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<p style="text-align: right;">Page 10</p> <p>1 methodology. 2 A. Can you define what you mean by 3 "methodology"? 4 Q. Let me ask you this. I assume in your 5 research you use methodology to pursue answers to 6 problems. 7 A. Yes. 8 Q. So how would you define "methodology"? 9 A. I would define methodology as -- as your 10 plan. 11 Q. And to pursue good science you would need a 12 good plan. 13 A. I would agree. 14 Q. Okay. And in reviewing a -- a methodology, 15 a methodology or plan should be repeatable; correct? 16 That's why you have a methodology. 17 A. I would say the results should be 18 reproducible. 19 Q. Okay. So if you have a good methodology the 20 results should be reproducible. 21 A. I want to be careful about not conflating 22 those two things. I mean, you can reproduce results 23 using a different methodology. The key is are the 24 results reproducible. 25 Q. Okay. So my understanding is you could have</p>	<p style="text-align: right;">Page 12</p> <p>1 Q. Well you've written many scientific papers; 2 correct? 3 A. Correct. 4 Q. And usually there's a method -- a methods 5 section in the paper; correct? 6 A. A methods or an equivalent of a methods 7 section. 8 Q. Yes. There's some -- There's some section 9 that says what you did and how you did it. 10 A. Yes. 11 Q. Okay. And the reason why that's there is 12 for someone else that's reviewing the paper, it's 13 there to understand the methodology that you used in 14 performing your research. 15 A. Correct. 16 Q. Okay. And to determine whether or not the 17 methodology you used is in fact correct? 18 A. Yes. 19 Q. Whether it is reasonable? 20 A. Yes. 21 Q. Whether it is a methodology used and well 22 respected in the scientific community. 23 A. Yes. 24 Q. Okay. And in fact you've written papers on 25 biases and errors with respect to issues in research.</p>
<p style="text-align: right;">Page 11</p> <p>1 a different methodology but obtain repeatable results. 2 A. Yes. 3 Q. Okay. But -- But the -- 4 But whichever methodology you use, the 5 methodology has to be reasonable. 6 A. I would agree the methodology has to be 7 reasonable. 8 Q. And with respect to methodology there might 9 be multiple methodologies, but they should be 10 identified so someone in the community could determine 11 whether or not there's any potential biases in the 12 methodology. 13 A. Yes. 14 Q. And with respect to methodology, one of the 15 key is is that you need to communicate any assumptions 16 you make in the methodology. 17 A. You need to communicate assumptions that are 18 relevant that you expect could affect the results. 19 Q. Okay. And you would identify those in the 20 methodology. 21 A. I mean, it depends on how broad you're 22 interpreting the term "methodology." If your 23 methodology, for example, is a test plan or a 24 simulation method -- 25 Could you restate your question?</p>	<p style="text-align: right;">Page 13</p> <p>1 A. Yes. 2 Q. And in fact you wrote an article in the 3 Bulletin of the American Meteorological Society titled 4 XBT science: Assessment of XBT biases and errors. 5 A. I -- I wrote an article -- 6 The title sounds correct. 7 Q. Uh-huh. 8 A. I'm assuming you read it correctly, but yes, 9 I wrote an article that is either that exact title or 10 something similar. 11 Q. And it's important to communicate all your 12 assumptions in your methodology because until research 13 -- Strike that. 14 You mentioned you make -- you have to 15 identify assumptions that may affect the results of 16 your research; correct? 17 A. Correct. 18 Q. Okay. And it's important to communicate all 19 -- it's important to communicate all your assumptions, 20 because until research is -- the research is complete, 21 you may not know whether the assumptions you make -- 22 you made impact the outcome. 23 A. I disagree. 24 Q. Why? 25 A. Because some assumptions you make are so</p>

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<p style="text-align: right;">Page 14</p> <p>1 trivial you know they would not affect the results. 2 So I would -- I would amend your question, change your 3 question to not use the word "all" assumptions, but I 4 would say the important assumptions. 5 Q. Okay. So -- 6 But you want to identify them and 7 communicate them in the methodology because for the 8 important assumptions, until the research is complete 9 you may not know whether those important assumptions 10 you made impact the outcome. 11 A. Correct. 12 Q. Okay. And you agree with me that in any 13 type of research you do that you want to gather as 14 much information as possible regarding research that 15 has been done in the scientific community. 16 A. I don't necessarily agree with that, and I 17 can explain. You gather as much background 18 information as you need to understand what people have 19 done and what the current state of the art is and the 20 current state of the knowledge is. Let's say that I'm 21 doing a paper on XBT biases, which is the title of the 22 paper you read. 23 Q. I think I understand your answer, though. I 24 mean, I don't need an example. I think I understand 25 what you're saying.</p>	<p style="text-align: right;">Page 16</p> <p>1 would not like any guessing, I'd like your -- your 2 opinions without guessing. Fair enough? 3 A. Fair. 4 Q. And I don't think anyone here wants any 5 guessing. But I might ask you to guess like guess how 6 many hours you spent on something, that might be a 7 guess. But when it comes to your expert opinions we 8 don't want any guessing. Fair enough? 9 A. Fair. 10 MR. GOSS: I think we would -- rather than 11 use the word "guess," I think approximation is the 12 better term to use. 13 A. So if I could ask for a clarification. 14 Are you also asking me not to approximate, 15 or are you just asking me not to guess? 16 MR. GOSS: He'll let -- He'll let -- 17 Q. If the approx -- That's why -- 18 If the approximation isn't something you can 19 give as an expert opinion, for example, if I ask you a 20 temperature in this room, you know, you might say well 21 it's approximately between, you know, 70 and 75, you 22 know, that's within -- within your education, training 23 and expertise and just your experience. But to make 24 an outlying guess about something when you don't know 25 the answer, just say you don't know the answer.</p>
<p style="text-align: right;">Page 15</p> <p>1 A. But -- But if I give one it'll be clear for 2 the record. 3 Q. I get it though, I don't need -- I'm fine. 4 A. Okay. 5 Q. So with respect to determining whether or 6 not a -- an important assumption is correct or not, 7 how do you determine that? 8 A. Well you may look at someone else -- There's 9 a number of ways. 10 For example, you may find someone who has 11 done work in the past and they've articulated or shown 12 that a certain assumption matters or doesn't matter. 13 Maybe you've done work in the past and you've 14 quantified the effect of an assumption. Maybe the 15 assumption is obvious on its face. So there's a 16 number of ways where you might identify that an 17 assumption matters or doesn't matter. 18 Q. Umm-hmm. Well you agree with me that 19 certain assumptions can significantly affect the 20 results. 21 A. I agree. 22 Q. Now I forgot to give you this instruction, 23 but I'm going to ask you many questions today. I 24 don't -- Unless I ask you to guess or give an 25 approximation, when it comes to your expert opinions I</p>	<p style="text-align: right;">Page 17</p> <p>1 A. Thank you. 2 Q. Okay? 3 You said you had six other depositions as an 4 expert witness; correct? 5 A. Incorrect. I think I said I had six or 6 seven. 7 Q. Six or seven. 8 A. Sorry. 9 Q. Okay. Any of them deal with forced-air 10 warming? 11 A. No. 12 Q. Any of them deal with patient-warming 13 devices? 14 A. No. 15 Q. Would most of them be with respect to burn 16 cases? 17 A. No. 18 Q. What were the six or seven? 19 A. I've given a deposition related to a burn 20 case. I've given a number of depositions related to 21 intellectual property litigation. In fact I think, I 22 am quite certain, that the remaining depositions were 23 related to intellectual property cases. 24 Q. Okay. So one burn case and the rest dealing 25 with intellectual property cases.</p>

5 (Pages 14 to 17)

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<p style="text-align: right;">Page 18</p> <p>1 A. Correct.</p> <p>2 Q. And they would be patent litigation cases?</p> <p>3 A. Correct, if -- if "patent litigation cases"</p> <p>4 would include things like International Trade</p> <p>5 Commission, Inter Partes Review.</p> <p>6 Q. Okay.</p> <p>7 A. But I would just say within the intellectual</p> <p>8 property realm.</p> <p>9 Q. Okay.</p> <p>10 A. I don't know if they are technically</p> <p>11 considered patent litigation cases.</p> <p>12 Q. Fair enough.</p> <p>13 Now as an expert in this case you agree with</p> <p>14 me that you are supposed to be objective.</p> <p>15 A. Yes.</p> <p>16 Q. You're not supposed to be an advocate for</p> <p>17 either side in this case; correct?</p> <p>18 A. Correct.</p> <p>19 Q. And as a professor, you agree that providing</p> <p>20 false data or results would be fraudulent.</p> <p>21 A. Correct.</p> <p>22 Q. Okay. And if your research provided false</p> <p>23 data or results that would be considered research</p> <p>24 fraud; correct?</p> <p>25 A. If it knowingly --</p>	<p style="text-align: right;">Page 20</p> <p>1 of the opinions you put in your report is incorrect,</p> <p>2 or not accurate, or if you even change your opinions</p> <p>3 today, that -- that you will tell me today?</p> <p>4 A. Yes.</p> <p>5 Q. Okay. This is the time for me to take your</p> <p>6 deposition and ask you questions about your opinions</p> <p>7 and all your opinions in this case. You understand</p> <p>8 that.</p> <p>9 A. Yes.</p> <p>10 Q. Okay. And when I leave here today I expect</p> <p>11 to have all your opinions outlined and understood that</p> <p>12 I could go back through the deposition and read. You</p> <p>13 understand that?</p> <p>14 A. I understand that.</p> <p>15 Q. Okay. You understand that I'm one of the</p> <p>16 attorneys working on behalf of over 2700 people who</p> <p>17 have filed lawsuits against 3M that they were harmed</p> <p>18 by the Bair Hugger.</p> <p>19 A. I do not understand that.</p> <p>20 Q. Okay. Do you understand that there's been</p> <p>21 over 2700 lawsuits in this case, in this litigation in</p> <p>22 Minnesota?</p> <p>23 A. I do not understand that.</p> <p>24 Q. Okay. So you, sitting here today, you don't</p> <p>25 know how many cases were fi -- have been filed.</p>
<p style="text-align: right;">Page 19</p> <p>1 I think if it's knowingly fraudulent, then</p> <p>2 yes.</p> <p>3 Q. Okay. And I take it you would never commit</p> <p>4 research fraud or put your name on a court document</p> <p>5 that you did not believe in.</p> <p>6 A. Correct.</p> <p>7 Q. You do understand that you are under oath</p> <p>8 today; correct?</p> <p>9 A. Correct.</p> <p>10 Q. And that's under penalty of perjury;</p> <p>11 correct?</p> <p>12 A. Correct.</p> <p>13 Q. And you understand what that means; correct?</p> <p>14 A. I think I do.</p> <p>15 Q. Did your lawyer not explain to you that</p> <p>16 sitting here today is like sitting in a courtroom,</p> <p>17 you're under oath and the same rules apply and the</p> <p>18 same penalties apply?</p> <p>19 A. I understand that.</p> <p>20 Q. Okay. And by the way, do you like to be</p> <p>21 called Mr. Abraham, Dr. Abraham, John, what do you</p> <p>22 like?</p> <p>23 A. For a deposition I'd prefer Dr. Abraham.</p> <p>24 Q. Okay. So Dr. Abraham, do you agree, or can</p> <p>25 we agree that if for any reason you discover that one</p>	<p style="text-align: right;">Page 21</p> <p>1 A. Correct.</p> <p>2 Q. Okay. Did you understand there were many</p> <p>3 cases that were filed?</p> <p>4 A. I would say I know there are a number of</p> <p>5 cases filed. "Many" -- I don't know the number.</p> <p>6 Q. Okay.</p> <p>7 A. Sitting here right now I do not know the</p> <p>8 number of cases filed.</p> <p>9 Q. You also understand that the plaintiffs have</p> <p>10 a right to determine all the methodologies you used to</p> <p>11 reach your opinions.</p> <p>12 A. Correct.</p> <p>13 Q. Okay. So that at the end we could test</p> <p>14 whether or not your methodologies are reliable.</p> <p>15 A. Correct.</p> <p>16 Q. And do you understand what I mean by</p> <p>17 "reliable"?</p> <p>18 A. Yes.</p> <p>19 Q. Like reproducible.</p> <p>20 A. Yes.</p> <p>21 Q. Okay.</p> <p>22 A. Actually that may not be quite right. You</p> <p>23 could have results which are reliable, but they may</p> <p>24 not be reproducible.</p> <p>25 Q. Okay. What do you mean by that in the</p>

6 (Pages 18 to 21)

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<p style="text-align: right;">Page 22</p> <p>1 science -- with respect to research in the scientific 2 community? 3 A. Let me give you an example. I work on areas 4 of patient-specific medical interventions, and let's 5 say I did an experiment on someone, on a person, and 6 let's say that person died or was other -- otherwise 7 unavailable for a repeat experiment. Someone could 8 not reproduce the experiment on that person, and 9 reproducing it on someone else would be slightly 10 different. 11 Q. Let me define it, then. I understand that 12 one outlier. 13 But with respect to your issues in this 14 case, computational fluid dynamics, heat transfer, the 15 laws of thermodynamics, you agree with me that if 16 something is reliable, it should be reproducible. 17 A. Yes. 18 Q. Okay. So moving on. 19 (Discussion off the stenographic record.) 20 (Abraham Exhibit 1 marked for 21 identification.) 22 BY MR. ASSAAD: 23 Q. What's been marked as Exhibit 1 is a copy of 24 your report that is -- was submitted to the plaintiffs 25 on June 2nd, 2017. I'll represent to you that this is</p>	<p style="text-align: right;">Page 24</p> <p>1 the final draft was early 2016? 2 A. No. 3 Q. Okay. When did you complete the final 4 draft? 5 A. Well the final draft would have been 6 completed after I received the expert report from Dr. 7 Elghobashi, so that part was added, that section was 8 added after -- after that date. 9 Q. Okay. Could we -- Could we -- 10 I'm going to just give you page numbers and 11 let me just see if we could go through this quickly. 12 Would you agree with me that pages 1 through 13 10, the first part, was completed by early 2016? 14 A. You said "10, the first part"? 15 Q. Page 10 and -- with paragraph subtitled B. 16 A. Yes. I -- To my best recollection, that 17 would have been completed early 2016. 18 Q. Okay. And then the part with respect to the 19 schlieren and -- and the criticisms of Elghobashi 20 would have been done probably this year, after you 21 received those reports. 22 A. Correct. 23 Q. Okay. And you've kept detailed bills with 24 respect to all the work you've done in this case. 25 A. Yes.</p>
<p style="text-align: right;">Page 23</p> <p>1 a copy -- a true copy of your report. If you want to 2 review it, you can review it at a break, but I don't 3 want to get into that issue right now. 4 Now my understanding is that this report 5 deals with the Bair Hugger Model 750 or 775; correct? 6 A. The Bair Hugger model is listed, I think 7 it's the -- 8 Is it listed in this report? If it's not 9 listed, then I'll say yes to that. 10 Q. Okay. 11 A. Yes, it's listed on page 5, third paragraph 12 from the bottom. 13 Q. Okay. And this report you do not -- 14 This report does not contain anything with 15 respect to any studies done on the Model 505; correct? 16 A. This report does not. 17 Q. Okay. 18 A. However, since drafting this report I have 19 analyzed that blower system. 20 Q. Okay. When was this report drafted? 21 A. I'm going to estimate. 22 Q. Okay. 23 A. I would estimate early 2016, but I don't 24 have an exact date. 25 Q. And what was when you -- when you completed</p>	<p style="text-align: right;">Page 25</p> <p>1 Q. Okay. So would you agree with me that this 2 report was completed with respect to your CFD, not 3 your criticisms of the schlieren, prior to Science Day 4 where you testified in front of the Court in this 5 case? 6 A. Yes. 7 Q. And let me just correct one thing. Go to 8 page 11 and the top of 12. Was that -- part D, 9 section D. Would that have been part of your report 10 in January of 2016, or was that added later on? 11 A. That would have been part of the original, 12 the early -- 13 Q. Okay. 14 A. -- the early report. 15 Q. Okay. So now we have, just to be clear and 16 for the record, pages 1 through 10 of -- section B of 17 10, and pages 11, section D, which completes on 18 section 12, was all completed in January of 2016. 19 MR. GOSS: Object to form. 20 MR. ASSAAD: Basis? 21 MR. GOSS: I think he said "early" 2016. 22 Q. Early 2016. 23 A. That is the best of my recollection. 24 Q. And definitely before Science Day in this 25 case.</p>

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<p style="text-align: right;">Page 26</p> <p>1 A. Yes.</p> <p>2 Q. Okay. Now for today's deposition all my</p> <p>3 questions will be with respect to the report that we</p> <p>4 have as -- marked as Exhibit 1. You understand that.</p> <p>5 A. I understand it because you've just told me.</p> <p>6 Q. Okay. Any work that you did on the 505 is</p> <p>7 not part of this report so we're not going to talk</p> <p>8 about that today. You understand that?</p> <p>9 A. I do.</p> <p>10 Q. Okay.</p> <p>11 (Abraham Exhibit 2 marked for</p> <p>12 identification.)</p> <p>13 BY MR. ASSAAD:</p> <p>14 Q. What's been marked as Exhibit 2 is a copy of</p> <p>15 your curriculum vitae that was provided to us with</p> <p>16 your report. Is this the most --</p> <p>17 Is this an accurate copy of your CV?</p> <p>18 A. (Witness reviewing exhibit.) This would be</p> <p>19 an accurate copy of my CV at the time it was produced.</p> <p>20 Q. Okay. I assume there might be a few new</p> <p>21 publications?</p> <p>22 A. Correct.</p> <p>23 Q. Any publications dealing with</p> <p>24 patient-warming devices?</p> <p>25 A. No.</p>	<p style="text-align: right;">Page 28</p> <p>1 Exhibit 1. Do you recall this document?</p> <p>2 A. No.</p> <p>3 Q. Have you ever seen this document before?</p> <p>4 A. I don't recall seeing this document.</p> <p>5 Q. Okay. This was provided to us by defense</p> <p>6 counsel discussing all the materials considered by you</p> <p>7 in -- in -- and relied upon in formulating your</p> <p>8 opinions in this case.</p> <p>9 Do you agree with me that this is a complete</p> <p>10 list of the materials you considered that formulated</p> <p>11 your opinions in -- that are identified in Exhibit 1?</p> <p>12 Let me rephrase that. I'm going to go back</p> <p>13 a little bit.</p> <p>14 Exhibit 1 has references; correct?</p> <p>15 A. Correct.</p> <p>16 Q. Okay. So if you take those references along</p> <p>17 with this Exhibit 3, would that constitute all the</p> <p>18 materials you considered and relied upon in</p> <p>19 formulating your opinions?</p> <p>20 A. (Witness reviewing exhibits.) We'd have to</p> <p>21 include the -- the videos, which I -- which I mention</p> <p>22 explicitly in the report. They're not in the</p> <p>23 reference list of the report. I'm trying to think of</p> <p>24 anything that would not be in these two groups.</p> <p>25 Sitting here now I cannot think of anything</p>
<p style="text-align: right;">Page 27</p> <p>1 Q. Any publications dealing with the issues in</p> <p>2 this case?</p> <p>3 A. No.</p> <p>4 Q. Okay. And it seems like you've written</p> <p>5 about 100, 102 publications since 2010.</p> <p>6 A. That sounds about right.</p> <p>7 Q. Okay. About 15 publications per year; that</p> <p>8 sound about right?</p> <p>9 A. Yes.</p> <p>10 Q. Okay. And I take it these are publications</p> <p>11 which you have worked with research students as their</p> <p>12 advisor, or research that St. Thomas is doing that</p> <p>13 you've coauthored with other people; correct?</p> <p>14 A. Oftentimes, yes.</p> <p>15 Q. Okay. Are you the main writer in many of</p> <p>16 these publications, or just the advisor overseeing the</p> <p>17 research?</p> <p>18 A. I am usually the main writer.</p> <p>19 Q. Okay. Now --</p> <p>20 (Abraham Exhibit 3 marked for</p> <p>21 identification.)</p> <p>22 BY MR. ASSAAD:</p> <p>23 Q. What's been marked as Exhibit 3 is a</p> <p>24 document that was provided to us of all the materials</p> <p>25 you considered with respect to your expert report of</p>	<p style="text-align: right;">Page 29</p> <p>1 not in one of these two groups.</p> <p>2 Q. Okay. And if you do later on, just say,</p> <p>3 hey, I forgot to include this on Exhibit C.</p> <p>4 A. Thank you.</p> <p>5 Q. Okay?</p> <p>6 Now have you had a chance to review your</p> <p>7 report before today's deposition?</p> <p>8 A. I didn't quite hear that question. Could</p> <p>9 you --</p> <p>10 Q. Have you reviewed your report before today's</p> <p>11 deposition?</p> <p>12 A. Yes.</p> <p>13 Q. Okay. And I assume you met with counsel and</p> <p>14 went over your report; correct?</p> <p>15 A. I met with counsel, but I don't recall going</p> <p>16 over the report.</p> <p>17 Q. Okay. But you recently reviewed your</p> <p>18 report.</p> <p>19 A. Yes.</p> <p>20 Q. Any corrections you would like to make to</p> <p>21 your report before we begin discussing your report?</p> <p>22 A. Not at this time.</p> <p>23 Q. Okay. All the opinions you intend to offer</p> <p>24 to the court and the jury in this matter are contained</p> <p>25 in your report; correct?</p>

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<p style="text-align: right;">Page 30</p> <p>1 A. Well the only other opinion that I have</p> <p>2 that's not in this report is that lower flow blankets</p> <p>3 -- lower flow forced-air warming devices also do not</p> <p>4 interrupt the airflow in an operating room, but aside</p> <p>5 from that, yes.</p> <p>6 Q. When you say "lower flow," are you talking</p> <p>7 about devices such as the Mistral?</p> <p>8 A. No.</p> <p>9 Q. What -- What's lower flow?</p> <p>10 A. 505.</p> <p>11 Q. Okay. You stand by your report?</p> <p>12 A. Yes.</p> <p>13 Q. You checked your report for any type of</p> <p>14 error, mathematical or computational?</p> <p>15 A. Yes.</p> <p>16 Q. And you believe that all the numbers in your</p> <p>17 report are correct.</p> <p>18 A. Yes.</p> <p>19 Q. Okay. My understanding is, and I'll get</p> <p>20 into more detail, but the main opinions I obtained</p> <p>21 from your report is that the Bair Hugger does not</p> <p>22 disrupt airflow; correct? Over the surgical site.</p> <p>23 A. That is one opinion.</p> <p>24 Q. Okay. That the Bair Hugger does not</p> <p>25 increase the temperature around the surgical table.</p>	<p style="text-align: right;">Page 32</p> <p>1 were 62 for an 8.1 million-grid-cell calculation.</p> <p>2 A. Thank you for that correction.</p> <p>3 Q. Okay. My understanding is besides those</p> <p>4 temperature measurements that we've just identified,</p> <p>5 you did not take any other temperature measurements in</p> <p>6 the room during your experiment.</p> <p>7 A. Correct.</p> <p>8 Q. You did not take any measurements of the</p> <p>9 drape temperature; correct?</p> <p>10 A. Correct.</p> <p>11 Q. You did not take any measurements of the</p> <p>12 temperature above the surgical site.</p> <p>13 A. Correct.</p> <p>14 Q. And if you go to page 12 of your report, you</p> <p>15 would agree with me that this is a -- a represent --</p> <p>16 this is a view of the temperature represented in the</p> <p>17 operating room with respect to your CFD analysis along</p> <p>18 that plane.</p> <p>19 A. Yes.</p> <p>20 Q. Okay. And my understanding is also</p> <p>21 validated by smoke tests?</p> <p>22 A. I don't know if I used the word "smoke."</p> <p>23 Did I use the word "smoke" in this?</p> <p>24 Q. I don't know. Did --</p> <p>25 I mean, did you use smoke tests?</p>
<p style="text-align: right;">Page 31</p> <p>1 A. That is another opinion.</p> <p>2 Q. Okay. You also claim that you val -- you</p> <p>3 validated your CFD by temperature measurements;</p> <p>4 correct?</p> <p>5 A. Correct.</p> <p>6 Q. And you did that by doing measurements on</p> <p>7 the floor and the edge of the bed; correct?</p> <p>8 A. Those were two locations, correct.</p> <p>9 Q. Were there any other locations that you</p> <p>10 measured temperature?</p> <p>11 A. Yes.</p> <p>12 Q. Where else?</p> <p>13 A. I took a number of temperatures in the room.</p> <p>14 Q. And what page are you looking at?</p> <p>15 A. The bottom of page 5.</p> <p>16 Q. Okay.</p> <p>17 A. And had a room average temperature of 62</p> <p>18 degrees Fahrenheit. And I think you mentioned on the</p> <p>19 -- near the floor, I think you mentioned that.</p> <p>20 Q. Yes.</p> <p>21 A. That's one location. And yes, at the edge</p> <p>22 of the bed.</p> <p>23 Q. I'm going to correct you for a little bit.</p> <p>24 I believe you measured -- your experimental</p> <p>25 measurements was 61 and your calculated measurements</p>	<p style="text-align: right;">Page 33</p> <p>1 A. Well technically it's not smoke.</p> <p>2 Q. It's water vapor; correct?</p> <p>3 A. Visible --</p> <p>4 Condensed water droplets.</p> <p>5 Q. Okay.</p> <p>6 A. And maybe for -- for this deposition I'm</p> <p>7 going to use the term "visible water vapor," but --</p> <p>8 Q. Okay.</p> <p>9 A. -- but that's a -- that's not a technical</p> <p>10 term.</p> <p>11 Q. So you used visible water vapor in your</p> <p>12 validation; correct?</p> <p>13 A. Correct.</p> <p>14 Q. Okay. And you did that yourself.</p> <p>15 A. Yes.</p> <p>16 And let me go back to a question you asked,</p> <p>17 did I measure any other temperatures? I actually did</p> <p>18 one that I had forgotten about. I measured the</p> <p>19 temperature of the water vapor emerging from the water</p> <p>20 vapor machine.</p> <p>21 Q. What was that temperature?</p> <p>22 A. I recall it 62.5 Fahrenheit.</p> <p>23 Q. Do you have that written down somewhere?</p> <p>24 A. Yes.</p> <p>25 Q. Okay. And what device did you use for the</p>

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<p style="text-align: right;">Page 34</p> <p>1 visible water -- visible water machine?</p> <p>2 A. I recall it's a megasonic fog generator.</p> <p>3 Q. Can we just call it fog, a fog generator?</p> <p>4 A. Perfect.</p> <p>5 Q. Okay. That's much easier to say than the</p> <p>6 "visible water."</p> <p>7 A. I agree.</p> <p>8 Q. Is a fog generator a generally accepted</p> <p>9 method in the scientific community to validate CFD?</p> <p>10 A. Yes.</p> <p>11 (Abraham Exhibit 4 marked for</p> <p>12 identification.)</p> <p>13 BY MR. ASSAAD:</p> <p>14 Q. What's been marked as Exhibit 4 is a</p> <p>15 subpoena issued by myself to you dated June 7th, 2017</p> <p>16 for you to provide documents by June 21st, 2017.</p> <p>17 Have you seen this document before?</p> <p>18 A. Yes.</p> <p>19 Q. Okay. And this was given to you by counsel</p> <p>20 for 3M when they received it; correct?</p> <p>21 A. Yes.</p> <p>22 Q. Did you go through the subpoena and produce</p> <p>23 documents to 3M's attorneys that are responsive to</p> <p>24 this subpoena?</p> <p>25 A. No.</p>	<p style="text-align: right;">Page 36</p> <p>1 to a journal, but it's not a note.</p> <p>2 Q. Okay. So you've submitted this -- the -- a</p> <p>3 manuscript to a journal in this case --</p> <p>4 A. Yes.</p> <p>5 Q. -- regarding your testing?</p> <p>6 Who are the authors of that journal, or that</p> <p>7 manuscript?</p> <p>8 A. Well I -- I wrote the manuscript.</p> <p>9 Q. Is it listed in your resume?</p> <p>10 A. Yes, it is.</p> <p>11 Q. Okay.</p> <p>12 A. It is the number one listing under the</p> <p>13 wor -- section "Publications."</p> <p>14 Q. So do you have a copy of this manuscript</p> <p>15 with you today?</p> <p>16 A. No.</p> <p>17 Q. Has it been accepted?</p> <p>18 A. Yes.</p> <p>19 Q. Okay. And in there it talks about the Bair</p> <p>20 Hugger?</p> <p>21 A. I don't know if the name Bair Hugger is</p> <p>22 used.</p> <p>23 Q. Does it talk about a forced-air warming</p> <p>24 device?</p> <p>25 A. Yes.</p>
<p style="text-align: right;">Page 35</p> <p>1 Q. Why not?</p> <p>2 A. I don't believe --</p> <p>3 Well I produced the documents to Blackwell</p> <p>4 Burke attorneys, --</p> <p>5 Q. Yes.</p> <p>6 A. -- not to 3M attorneys.</p> <p>7 Q. They're 3M attorneys.</p> <p>8 A. Oh.</p> <p>9 (Laughter.)</p> <p>10 A. My naivete on this whole matter, the legal</p> <p>11 matters.</p> <p>12 Q. Okay. Okay.</p> <p>13 A. But yes, I produced documents to Blackwell</p> <p>14 Burke attorneys related to this subpoena.</p> <p>15 Q. Okay. Let's go to page four. Now you</p> <p>16 mentioned -- I'm going to only go through a few of</p> <p>17 them. You just mentioned you had some notes that you</p> <p>18 created during your whole -- the whole process of</p> <p>19 preparing -- of taking data and preparing your report?</p> <p>20 A. No. I did not say that.</p> <p>21 Q. So you said the 62.5 temperature for the fog</p> <p>22 generator, you said that was written down someplace.</p> <p>23 A. That's correct.</p> <p>24 Q. Where is it written down?</p> <p>25 A. It's written down in a manuscript submitted</p>	<p style="text-align: right;">Page 37</p> <p>1 Q. Okay. And is it with the 505 or the 750</p> <p>2 model?</p> <p>3 A. Both.</p> <p>4 Q. Okay. And you wrote this with B. D.</p> <p>5 Plourde; is that how you pronounce it?</p> <p>6 A. Plourde.</p> <p>7 Q. Plourde. And Ms. Vallez?</p> <p>8 A. Correct.</p> <p>9 Q. Okay. Did those two assist you with the CFD</p> <p>10 analysis that is the subject of your report?</p> <p>11 A. No.</p> <p>12 Q. So it's my understanding that the report --</p> <p>13 the -- the creation of the CFD and the results was all</p> <p>14 created by you?</p> <p>15 A. All of the results contained in the document</p> <p>16 and in my expert report were created by me.</p> <p>17 Q. What about the geometry?</p> <p>18 A. The geometry was not created by me.</p> <p>19 Q. Who was it created by?</p> <p>20 A. I don't know the answer to that.</p> <p>21 Q. Was it given to you?</p> <p>22 A. Yes.</p> <p>23 Q. By whom?</p> <p>24 A. If I recall, it was supplied by an attorney,</p> <p>25 but it would have been two years ago. I don't recall</p>

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<p style="text-align: right;">Page 38</p> <p>1 the person.</p> <p>2 Q. Was it Lori Cohen?</p> <p>3 A. No.</p> <p>4 Q. Christiana Jaxsens?</p> <p>5 A. No.</p> <p>6 Q. Evan Holden?</p> <p>7 A. No.</p> <p>8 Q. Okay. Was it someone from Greenberg</p> <p>9 Traurig?</p> <p>10 A. I believe so.</p> <p>11 Q. And this was submitted to Numerical Heat</p> <p>12 Transfer, your -- a journal, we're discussing?</p> <p>13 A. Yes.</p> <p>14 Q. Okay. And when's it going to be published?</p> <p>15 A. I don't know.</p> <p>16 Q. Okay. On the journal, did you inform the</p> <p>17 journal that this research was funded by 3M?</p> <p>18 A. Yes. It is listed in the supporting section</p> <p>19 or the acknowledgment section.</p> <p>20 Q. Okay. Did you inform the journal that the</p> <p>21 geometry that was created was not created by you?</p> <p>22 A. No.</p> <p>23 Q. Where did you obtain the data that you --</p> <p>24 the 62.5 degrees for the journal? Did you have that</p> <p>25 just memorized regarding the temperature of the fog</p>	<p style="text-align: right;">Page 40</p> <p>1 counsel?</p> <p>2 A. No.</p> <p>3 Q. Did Mr. Plourde or Ms. Vallez provide any</p> <p>4 work with respect to the CFD analysis you performed on</p> <p>5 the 750?</p> <p>6 A. No.</p> <p>7 Q. So even though part of your agreement with</p> <p>8 3M was to -- that the money was to be used for a staff</p> <p>9 member and a student, you did not obtain a student or</p> <p>10 a -- or a staff member to work on the project.</p> <p>11 A. Incorrect.</p> <p>12 Q. So you did obtain a student.</p> <p>13 A. Yes.</p> <p>14 Q. What student did the work?</p> <p>15 A. Lauren Vallez.</p> <p>16 Q. Okay. So she did help you on the 750</p> <p>17 analysis?</p> <p>18 A. Incorrect.</p> <p>19 Q. Okay.</p> <p>20 (Discussion off the stenographic record.)</p> <p>21 (Abraham Exhibit 5 marked for</p> <p>22 identification.)</p> <p>23 BY MR. ASSAAD:</p> <p>24 Q. What's been marked as Exhibit 5 is a</p> <p>25 document that the plaintiffs have received yesterday,</p>
<p style="text-align: right;">Page 39</p> <p>1 generator?</p> <p>2 A. Yes.</p> <p>3 Q. Okay. So my understanding is you did not</p> <p>4 create any notes.</p> <p>5 A. Incorrect.</p> <p>6 Q. So you did create notes.</p> <p>7 A. Yes.</p> <p>8 Q. Where are the notes?</p> <p>9 A. I had one note on a yellow sheet of paper</p> <p>10 like this [indicating], a note to myself about whether</p> <p>11 I had a reference, a certain reference. And when I</p> <p>12 confirmed that I had the reference, I discarded that</p> <p>13 note.</p> <p>14 Q. Okay. So sitting here today there are no</p> <p>15 written notes in your possession regarding your</p> <p>16 research or your analysis performed in your expert</p> <p>17 report.</p> <p>18 A. Sitting here today there are no notes</p> <p>19 regarding the analysis in my expert report. The only</p> <p>20 other notes that I would have would be annotations on</p> <p>21 journal papers, as I read through journal papers and I</p> <p>22 make notes.</p> <p>23 Q. On the journal papers?</p> <p>24 A. Correct.</p> <p>25 Q. Okay. Did you provide those to 3M's</p>	<p style="text-align: right;">Page 41</p> <p>1 June -- July 19th, 2017 in response to the subpoena.</p> <p>2 Do you recog --</p> <p>3 Do you recognize what's been marked as</p> <p>4 Exhibit 15 -- or Exhibit 5?</p> <p>5 A. Yes.</p> <p>6 Q. Okay. And this is the research proposal</p> <p>7 written by you to 3M; correct?</p> <p>8 A. Yes.</p> <p>9 Q. Even though you were dealing with 3M's</p> <p>10 attorneys at the time, which was Greenberg Traurig,</p> <p>11 this proposal is directed to 3M; correct?</p> <p>12 A. Correct.</p> <p>13 Q. Okay. And in the last paragraph it says:</p> <p>14 "The duration and cost of this project is \$12,000 and</p> <p>15 one month. This is a fixed cost grant and will</p> <p>16 support the employment of one student, one staff</p> <p>17 member, and all other university costs."</p> <p>18 Did I read that correctly?</p> <p>19 A. Yes.</p> <p>20 Q. Was a student employed with respect to this</p> <p>21 project?</p> <p>22 A. Yes.</p> <p>23 Q. Who?</p> <p>24 A. Lauren Vallez.</p> <p>25 Q. Okay. What did she do on the project?</p>

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<p style="text-align: right;">Page 42</p> <p>1 A. She actually didn't accomplish anything. 2 The -- It turns out the simulation was very 3 challenging and she wasn't able to contribute 4 meaningfully in any way. She didn't contribute in any 5 way to the generation of the mesh, to the setting of 6 the boundary conditions, and to the analysis. 7 Q. Okay. 8 A. But she was still paid. 9 Q. Okay. And was there a staff member used? 10 A. Yes. 11 Q. Who? 12 A. Brian Plourde. 13 Q. Okay. What was his role in -- with respect 14 to the CFD analysis? 15 A. It was the same. It turns out the 16 calculations -- All of the calculations in the report 17 and in the journal paper were done by me. The problem 18 was too complex and the timeline was too short for him 19 to contribute meaningfully. 20 Q. So you agree with me that the -- the model 21 is a complex model. 22 A. Yes. 23 Q. Okay. All right. Did the lawyers in this 24 case provide you any documents? 25 A. Yes.</p>	<p style="text-align: right;">Page 44</p> <p>1 through a tube that fed a Bair Hugger. And I think 2 that there was some schematics of an operating room, 3 if I recall correctly. 4 Q. Did you use that document in any way with 5 respect to your CFD analysis? 6 A. Yes. 7 Q. How did you use the document? 8 A. I confirmed my understanding of the airflow 9 going through a Bair Hugger. 10 Q. And we're talking about determining the mass 11 flow through the Bair Hugger? 12 A. Yes. 13 Q. Okay. Anything else you used in that 14 document? 15 A. I don't believe so. 16 Q. Did you provide that document to counsel in 17 response to our subpoena? 18 A. I'm certain -- I'm certain I would have 19 provided that document. 20 Q. Okay. 21 MR. ASSAAD: Do you have that document? 22 MR. GOSS: I believe it was produced 23 separately in response to an earlier subpoena, when 24 you subpoenaed Jennifer Wagner and John Abraham. 25 MR. ASSAAD: Well that's different than</p>
<p style="text-align: right;">Page 43</p> <p>1 Q. Well they provided you the geometry; 2 correct? 3 A. Yes. 4 Q. But with respect to documents, what 5 documents did they provide you? 6 A. I was provided a literature archive. 7 Q. Is that listed in -- in any of your 8 references or Exhibit 3? 9 A. Probably not because I did not use their 10 literature archive. 11 Q. Okay. 12 A. I was provided deposition transcripts. 13 Q. Okay. 14 A. I'm trying to -- I'm struggling to think of 15 oth -- 16 Other things may come to my mind, but those 17 were the two big things. 18 Q. Did they provide any internal documents, 19 internal testing of the Bair Hugger? 20 A. They -- There was a document of flow through 21 a Bair Hugger. Yes, they did provide a document. 22 Q. And what was that document? 23 A. Oh, man. It might have been called tech, 24 tech documents or something. All I remember from the 25 document is there was some testing of the airflow</p>	<p style="text-align: right;">Page 45</p> <p>1 subpoenaing him. I wanted to know what documents he 2 had. And I don't want what document you're talking 3 about or he's talking about, so I'd like to know what 4 document you're referring to and get a copy of that. 5 If it's already been produced, then it 6 should have been produced with his production; 7 correct? 8 MR. GOSS: I'm saying it's already -- to my 9 knowledge it's already been produced. We can 10 identify it. I think I know what he's talking about. 11 MR. ASSAAD: So my understanding is 3M is 12 only going to produce documents that Abraham has that 13 was not produced previously according to the 14 subpoena, even though the subpoena's directed to 15 Abraham? 16 MR. GOSS: I think we did our best to 17 comply with the subpoena. If we missed something 18 we'll go back and look for it and supply it. 19 MR. ASSAAD: Well can I get it at the next 20 break, please, if you know what you're talking about? 21 MR. GOSS: We will do our best to locate 22 it. 23 MR. ASSAAD: Well it seems like you know 24 what the document is, Peter Goss. 25 MR. GOSS: I think I do know what the</p>

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<p style="text-align: right;">Page 46</p> <p>1 document is --</p> <p>2 MR. ASSAAD: Well let's get --</p> <p>3 MR. GOSS: -- Gabriel Assaad.</p> <p>4 MR. ASSAAD: -- it produced then. Let's</p> <p>5 get it produced then, please.</p> <p>6 MR. GOSS: I will do my best.</p> <p>7 THE WITNESS: And if I could continue?</p> <p>8 Q. Sure.</p> <p>9 A. Sitting here I remember, I think, some</p> <p>10 communications with Augustine perhaps, or there may</p> <p>11 have been some kind of communications, emails that I</p> <p>12 received, but I don't recall what they were. And</p> <p>13 those were not used in the -- in these reports.</p> <p>14 Q. Did you produce all your files in this case?</p> <p>15 A. I believe I did. I am pretty sure I did. I</p> <p>16 mean certainly every file that is necessary for --</p> <p>17 that went into these reports.</p> <p>18 Q. What do you --</p> <p>19 What do you mean, "every file that is</p> <p>20 necessary"?</p> <p>21 A. Well, for example, I received a CAD file. I</p> <p>22 did not reproduce that CAD file because I produced a</p> <p>23 file in which the CAD file is contained.</p> <p>24 Q. Okay. Let me tell you what I've got -- been</p> <p>25 produced regarding files, you tell me if that's all</p>	<p style="text-align: right;">Page 48</p> <p>1 you might have it titled something different, but it</p> <p>2 was provided to us as Abraham 001, which was a Bates</p> <p>3 number, was the TRN file on the 750; correct?</p> <p>4 A. I don't know if that's the Bates number.</p> <p>5 Q. Okay.</p> <p>6 A. But the twenty -- 264.TRN would have been</p> <p>7 the results in CAD.</p> <p>8 Q. 254.</p> <p>9 A. 2540 is for the 505.</p> <p>10 Q. Okay. And the other one is the 750.</p> <p>11 A. Correct.</p> <p>12 Q. Are there any other TRN files for runs that</p> <p>13 you did that you changed later on?</p> <p>14 A. What do you mean by "changed"?</p> <p>15 Q. I mean, did you on -- did you only make one</p> <p>16 run, or did you refine, you know, and get multiple</p> <p>17 results and then came up with the final results?</p> <p>18 A. Yes, I did.</p> <p>19 Q. So are there other files showing those</p> <p>20 results?</p> <p>21 A. Yes.</p> <p>22 Q. And where are those?</p> <p>23 A. Those would be on my computer.</p> <p>24 Q. Do you have your computer here today?</p> <p>25 A. No. All of the results contained here are</p>
<p style="text-align: right;">Page 47</p> <p>1 the files.</p> <p>2 I was produced a AGDBT file. Is that the</p> <p>3 CAD file?</p> <p>4 A. Actually that would be the CAD file.</p> <p>5 Q. Okay. And I was provided a TRN file, one</p> <p>6 TRN file --</p> <p>7 A. Yep.</p> <p>8 Q. -- previously from the original subpoena.</p> <p>9 A. Umm-hmm.</p> <p>10 Q. Do you recall producing that?</p> <p>11 A. Yes.</p> <p>12 Q. And I received another TRN file that was</p> <p>13 called the 2540 that is -- that was produced subject</p> <p>14 to your -- the subpoena. Does that sound correct?</p> <p>15 A. Yes.</p> <p>16 Q. Are there any other files that you have?</p> <p>17 A. I don't think there's any other files that I</p> <p>18 have. I don't recall any other files that I have</p> <p>19 sitting here now.</p> <p>20 Q. Okay. So the only --</p> <p>21 And I don't know this for sure, and I was</p> <p>22 guessing based on the pictures that I received, but</p> <p>23 the 2540, is that your work on the 505?</p> <p>24 A. Yes, that's correct.</p> <p>25 Q. And the one that was titled "Abraham," which</p>	<p style="text-align: right;">Page 49</p> <p>1 from the 264 TRN, and other results are the sa -- give</p> <p>2 the same results as the ones shown here.</p> <p>3 Q. Just out of curiosity, what does "264" stand</p> <p>4 for?</p> <p>5 A. It's the time --</p> <p>6 It's a number indicator from the software as</p> <p>7 it saves results.</p> <p>8 Q. Okay. And what's the number mean? Does it</p> <p>9 mean anything?</p> <p>10 A. Time step.</p> <p>11 (Interruption by the reporter.)</p> <p>12 A. Time step.</p> <p>13 Q. Time step. Okay.</p> <p>14 Does it apply -- Is it a time --</p> <p>15 Does the value mean anything to you, 264?</p> <p>16 A. Yes.</p> <p>17 Q. What does it mean?</p> <p>18 A. It means it's the 264th calculation.</p> <p>19 Q. Calculation of what?</p> <p>20 A. Of the airflow in the room.</p> <p>21 Q. Okay. I might be confused, but I thought</p> <p>22 there was, like, thousands of calculations that the</p> <p>23 computer does before it gets a single result.</p> <p>24 A. That's correct.</p> <p>25 Q. So how can this --</p>

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<p style="text-align: right;">Page 50</p> <p>1 So why would this only be such a small 2 number, like 264, or am I mis -- or am I 3 misunderstanding something? 4 A. Yeah. I think you're confused. 5 Q. I know I'm confused because we just agreed 6 there's over a thousand calculations. 7 So what does -- Is the 264, is it 264 8 calculations, or 264 results? 9 A. There are many millions of calculations, and 10 in a problem like this you have to do the calculations 11 in time, you march forward in time. And so you have 12 to wait until what's called quasi-steady results 13 occur. And I used the 264th step for my quasi-steady 14 calculation. 15 Q. Okay. So it's the 264th step, not the 264th 16 calculation. 17 A. It's the 264th step, which is the 264th 18 calculation in time. 19 Q. Okay. I think I understand. Let me see if 20 I get this. 21 Each step might have millions of 22 calculations for each step; correct? 23 A. Correct. 24 Q. Okay. And each step represents a period of 25 time.</p>	<p style="text-align: right;">Page 52</p> <p>1 Q. Is that something that's in your report? 2 A. I'll have to look. (Witness reviewing 3 exhibit.) 4 Q. We have a lot to cover and I'm going to go 5 page-by-page, so let's look for it when we start going 6 page-by-page through your report later on, okay? 7 A. Great. 8 Q. So did you do any runs -- 9 Did you do any other runs before you came 10 with your final -- before you came up with your final 11 results? 12 A. Yes. 13 Q. Okay. What were different about those runs? 14 A. A calculation like this requires an initial 15 guess. These are what are called iterative 16 calculations, so you're guessing and checking and 17 guessing and checking. If you have a reasonable 18 initial guess, it speeds the -- what we call the 19 convergence. 20 So I did a calculation to get an initial 21 guess, which I then used as an input. And the effect 22 of that was to speed the process. 23 Q. Okay. How many of those did you do? 24 A. I think I would have done one. 25 Q. Okay. Do you have those results?</p>
<p style="text-align: right;">Page 51</p> <p>1 A. Correct. 2 Q. And 264 is the 264th period of time that you 3 got a result. 4 A. Yes. 5 Q. So where are the other 263 results? 6 A. I -- I didn't archive them because the 7 results are enormous and they fill up the hard drive. 8 I think I have two others, just to verify that I re -- 9 that I achieved steady state. 10 Q. Are they time steps before or after? 11 A. Both. 12 Q. How -- What's the -- the -- How far -- 13 What number after? 14 A. I think 300. 15 Q. Okay. And what about before; do you 16 remember the -- 17 A. I don't know. 18 Q. Okay. And I take it that 300, it actually 19 means something to you, the 300th time step? 20 A. Correct. 21 Q. Is a time step every second? 22 A. No. 23 Q. What's the time step, like in this case? 24 A. I don't recall what my time step was in the 25 calculation.</p>	<p style="text-align: right;">Page 53</p> <p>1 A. No. 2 Q. So those have been destroyed. 3 MR. GOSS: Object to form. 4 A. Well, I mean I -- there's no reason to keep 5 them. 6 Q. That wasn't my question. 7 My question is: They're no longer -- They 8 no longer exist. 9 A. I no longer -- 10 That's correct, they no longer exist. 11 Q. So you destroyed them. 12 MR. GOSS: Object to form. 13 Q. Let me -- Let me withdraw that question. 14 Do files -- 15 Is this on your personal computer or a St. 16 Thomas computer? 17 A. St. Thomas computer. 18 Q. Okay. And do you have to go physically 19 delete the file, or are they automatically deleted 20 over a certain period of time? 21 A. I -- I actually do the deletion. 22 Q. So you deleted those files. 23 A. Correct. 24 Q. When did you delete those files? 25 A. Proba --</p>

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<p style="text-align: right;">Page 54</p> <p>1 I don't know. I probably would have done it</p> <p>2 once I had obtained them and then I used the -- then I</p> <p>3 used them as the initial...</p> <p>4 I don't -- I don't know when I did.</p> <p>5 Q. Okay. Prior to writing this report?</p> <p>6 A. I would have to guess. I don't know.</p> <p>7 Q. So just so I understand, the only files</p> <p>8 available right now that you have on your computer are</p> <p>9 three -- with respect to the 750, are three TRN files,</p> <p>10 one which is the 264, one that's titled 300, and then</p> <p>11 one that's earlier than 264.</p> <p>12 A. Correct.</p> <p>13 Q. Okay. Any other files that you have</p> <p>14 available to you?</p> <p>15 A. No.</p> <p>16 Q. Okay. Are there any other files that you</p> <p>17 could obtain from your --</p> <p>18 Well let me ask you this: Do you still have</p> <p>19 the model?</p> <p>20 A. It's contained within the TRN.</p> <p>21 Q. Okay. So if I want --</p> <p>22 Can I reproduce your model through the TRN?</p> <p>23 A. Yes.</p> <p>24 Q. How would I do that?</p> <p>25 A. The TRN contains all of the information,</p>	<p style="text-align: right;">Page 56</p> <p>1 think you talked about converse or converge or</p> <p>2 convergence. Did you --</p> <p>3 You said something about convergence?</p> <p>4 A. Yes, I did.</p> <p>5 Q. What is --</p> <p>6 What is convergence?</p> <p>7 A. Convergence has two meanings.</p> <p>8 Q. In the CFD meaning.</p> <p>9 A. It has two CFD meanings.</p> <p>10 Q. Okay.</p> <p>11 A. Sorry.</p> <p>12 At each time step you can converge your</p> <p>13 solution to the correct solution. And another meaning</p> <p>14 is that over time you converge to a steady state, we</p> <p>15 call it quasi-steady result.</p> <p>16 Q. Okay. And is 264 a quasi-steady result?</p> <p>17 A. It was.</p> <p>18 Q. Okay. And that means that you came close to</p> <p>19 steady state?</p> <p>20 A. That means the results were no longer</p> <p>21 changing meaningfully over time.</p> <p>22 Q. Okay. Which is not true steady state, but</p> <p>23 quasi-steady state.</p> <p>24 A. That's correct.</p> <p>25 Q. Okay. I think I'm understanding this.</p>
<p style="text-align: right;">Page 55</p> <p>1 including the geometry, the mesh, the boundary</p> <p>2 conditions, the time stepping information. The TRN</p> <p>3 actually contains everything.</p> <p>4 Q. Okay. But it's at a certain time; correct?</p> <p>5 A. That is correct.</p> <p>6 Q. So how do I know what occurred before 264?</p> <p>7 Can I go backwards?</p> <p>8 A. You cannot go backwards.</p> <p>9 Q. So how do I know what your time zero was?</p> <p>10 A. Well the time zero's not relevant because</p> <p>11 that's just your initial guess. So the time -- The</p> <p>12 time zero result has no physical meaning.</p> <p>13 Q. But in this TRN your initial guess was -- or</p> <p>14 your initial -- your time zero wasn't an initial</p> <p>15 guess, or it was an educated assumption based on a</p> <p>16 previous file that you created.</p> <p>17 A. That's correct.</p> <p>18 Q. Okay. And this was a steady-state model;</p> <p>19 correct?</p> <p>20 A. No.</p> <p>21 Q. What was it then?</p> <p>22 A. It was an unsteady model.</p> <p>23 Q. Is that the same as transient?</p> <p>24 A. Yes.</p> <p>25 Q. Okay. I might have misunderstood you, but I</p>	<p style="text-align: right;">Page 57</p> <p>1 And how do you determine whether or not you</p> <p>2 have quasi-steady results?</p> <p>3 A. Well one way to determine that is to look at</p> <p>4 the results and see if they meaningfully change from</p> <p>5 one step to the next.</p> <p>6 Q. Okay. Are you looking at the results while</p> <p>7 you're running this?</p> <p>8 A. You can look at the results. I don't recall</p> <p>9 if I was, but you can look at them while you run.</p> <p>10 Q. Okay. And just so I understand that you're</p> <p>11 saying that if you looked at, I guess, time like 260,</p> <p>12 262, 263 and then 264, you're not seeing much of a</p> <p>13 change and therefore you could determine quasi-steady.</p> <p>14 A. That's correct.</p> <p>15 Q. Okay. And that is a judgment call based on</p> <p>16 the person doing the CFD.</p> <p>17 A. Yes.</p> <p>18 Q. Okay. Was there any correspondence between</p> <p>19 you and anyone besides attorneys for 3M regarding your</p> <p>20 work on this case, or your research work regarding the</p> <p>21 Bair Hugger?</p> <p>22 A. No.</p> <p>23 Q. What about with the journal?</p> <p>24 A. Oh, there would have been correspondence</p> <p>25 with the journal.</p>

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<p style="text-align: right;">Page 58</p> <p>1 Q. Did you provide those to counsel?</p> <p>2 A. I -- I don't recall if I did.</p> <p>3 MR. GOSS: We would invoke the Ingelfinger</p> <p>4 rule with respect to that correspondence.</p> <p>5 MR. ASSAAD: That rule only applies during</p> <p>6 the submission, but once it's accepted it no longer</p> <p>7 applies. And according to his -- his publications</p> <p>8 it's already been accepted.</p> <p>9 MR. GOSS: All right. Well it's a</p> <p>10 sauce-for-the-goose situation with respect to</p> <p>11 Elghobashi's correspondence with his journal.</p> <p>12 MR. ASSAAD: Well I'm telling you the</p> <p>13 distinction here, sir. The distinction is Elghobashi</p> <p>14 is still being under review. This has been accepted.</p> <p>15 MR. GOSS: I'm not aware that it isn't</p> <p>16 still under review.</p> <p>17 MR. ASSAAD: It says right here,</p> <p>18 "accepted."</p> <p>19 MR. GOSS: Okay.</p> <p>20 MR. ASSAAD: Exhibit 2, page 12, under the</p> <p>21 number 1 publication, quote, accepted,</p> <p>22 A-C-C-E-P-T-E-D, closed quote. So it's -- we're in a</p> <p>23 different situation here.</p> <p>24 Are you saying you're not going to produce</p> <p>25 that document under the -- under the law?</p>	<p style="text-align: right;">Page 60</p> <p>1 on the 750 between St. Thomas and 3M; correct?</p> <p>2 A. Yes.</p> <p>3 Q. Okay. Are there any other engagement</p> <p>4 agreements that exist with respect to your time on</p> <p>5 this case as a consultant, an expert for 3M?</p> <p>6 A. Well I would say this isn't one of those.</p> <p>7 This isn't a engagement agreement with me as an</p> <p>8 expert.</p> <p>9 Q. I understand that.</p> <p>10 I'm saying are there any engagement</p> <p>11 agreements between you and 3M or the attorneys for 3M?</p> <p>12 A. I -- I'm quite certain there isn't.</p> <p>13 Q. Okay. Is there a similar document with</p> <p>14 respect to Exhibit 5 for your work on the 505?</p> <p>15 A. I think there was a working draft, but not a</p> <p>16 final draft. I think the -- if I recall, the final</p> <p>17 proposal was by -- was verbal.</p> <p>18 Q. Okay. And I know I wasn't going to ask much</p> <p>19 about the 505, but did you use the same type of</p> <p>20 methodology on your analysis of the 505 as you did</p> <p>21 with the 750?</p> <p>22 A. Yes.</p> <p>23 Q. Okay. And with respect to determining the</p> <p>24 quasi-steady state by looking at the instantaneous</p> <p>25 velocity, what did you consider a meaningful, I guess</p>
<p style="text-align: right;">Page 59</p> <p>1 MR. GOSS: We are not producing it today.</p> <p>2 MR. ASSAAD: Okay. Let's take a break.</p> <p>3 THE REPORTER: Off the record, please.</p> <p>4 (Recess taken from 10:39 to 10:50 a.m.)</p> <p>5 BY MR. ASSAAD:</p> <p>6 Q. To determine whether or not you had a</p> <p>7 quasi-steady result, what do you look at, in this</p> <p>8 case?</p> <p>9 A. The patterns of flow.</p> <p>10 Q. When you say "patterns," what do you mean by</p> <p>11 "patterns"?</p> <p>12 A. In this case I looked at the streamlines,</p> <p>13 which you can think of as an instantaneous pattern of</p> <p>14 flow, and I compared streamlines.</p> <p>15 Q. And is the streamline based on velocity?</p> <p>16 A. Yes.</p> <p>17 Q. Okay. Are you looking at the instantaneous</p> <p>18 velocity or the average velocity?</p> <p>19 A. Instantaneous.</p> <p>20 Q. Okay. Did you look at anything else besides</p> <p>21 the streamlines?</p> <p>22 A. No.</p> <p>23 Q. As you can see from Exhibit 5, which is the</p> <p>24 St. Thomas proposal, I understood that's probably the</p> <p>25 engagement agreement between -- to perform the study</p>	<p style="text-align: right;">Page 61</p> <p>1 the term was convergence, what change, like what would</p> <p>2 be a non-meaningful change that you could say this is</p> <p>3 quasi-steady state?</p> <p>4 A. It was by visual inspection, not</p> <p>5 quantitative comparison.</p> <p>6 Q. Okay. So if I asked you today to show me</p> <p>7 the results that you looked at to determine</p> <p>8 quasi-steady state that's something that you couldn't</p> <p>9 put together because you don't have those files any</p> <p>10 more; correct?</p> <p>11 A. I disagree.</p> <p>12 Q. Okay. What would you look at?</p> <p>13 A. I could compare the results at two different</p> <p>14 time steps to show that there's no meaningful</p> <p>15 difference in the streamlines, and that's what I would</p> <p>16 provide you.</p> <p>17 Q. Okay. So you'd compare it to the two other</p> <p>18 files that you have.</p> <p>19 A. That's one way. Absolutely.</p> <p>20 Q. What would be the other way?</p> <p>21 A. It would be to compare two files.</p> <p>22 Q. Okay. But the only files that you have are</p> <p>23 the 264, the 300 and another file before 264.</p> <p>24 A. That -- Those are the two files related to</p> <p>25 this expert report. In my journal paper I made a</p>

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<p style="text-align: right;">Page 62</p> <p>1 further comparison where the two results differed by 2 maybe 2,000 time steps, and I did a side-by-side 3 comparison of those. 4 Q. So you ran it again for your journal paper? 5 A. No. 6 Q. I'm really confused now. So -- 7 A. It was the same calculation. 8 Q. What do you mean by the "same calculation"? 9 A. I ran the simulation once. 10 Q. And how far did you run it? 11 A. At least to 2500 time steps. 12 Q. Okay. And do you have any of that data 13 available? 14 A. I may have the data at 2500, I would have to 15 check. But that data would show that over that entire 16 time period there's no meaningful difference. And 17 that comparison was in -- is in the journal paper. 18 Q. Why did you not put that information in your 19 expert report? 20 A. What I put in the expert report is this, 21 images from figures 3 through 8 could be replicated -- 22 I'm on page 9 of Exhibit 1. "Images from figures 3-8 23 could be replicated at other time instances and the 24 same conclusions would be drawn." 25 So I assessed them and I state that the</p>	<p style="text-align: right;">Page 64</p> <p>1 what temperature? 2 A. For the journal paper I ran a calculation 3 where the temperature emerging from the Bair Hugger 4 was 43 Celsius. 5 Q. Okay. Now the opinions that you're going to 6 be giving in today's deposition, they're based on the 7 initial CFD analysis that was completed by January of 8 2016 with respect to the 750; correct? 9 A. They're based on the initial CFD analysis. 10 I don't know if they were completed by January of 11 2016, but they are based on the initial CFD analysis. 12 Q. Okay. And you agree with me there's nothing 13 in your report that identifies the equations that you 14 used with respect to your analysis of the problem. 15 A. I agree. 16 Q. Okay. Now I asked you what the time step 17 was, and I know you looked through your report 18 somewhere. Did you see anything about the time step 19 that was used? 20 A. The only thing I saw was the statement that 21 the results at other time steps lead to the same 22 conclusions. 23 Q. Is -- Is a time step, is that a -- is it a 24 constant time between, like, 263 and 264? 25 A. Yes.</p>
<p style="text-align: right;">Page 63</p> <p>1 results are the same at other instances. 2 Q. Okay. I assume there is much more detail in 3 your publication which is -- which has been submitted 4 for publication than in your expert report. 5 A. There's different detail. I don't know if 6 I'd say "much more," but there's different detail. 7 Q. What's the different detail? 8 A. Well, for example, in a journal paper I 9 would have never included a critique of Said 10 Elghobashi. 11 Q. I'm talking to the -- with respect to your 12 CFD analysis, not the critiques, but. 13 A. Thanks for that clarification. 14 There is more detail related to the CFD in 15 my journal paper. 16 Q. What detail is there in the journal paper? 17 A. Some equations are included. 18 Q. Okay. 19 A. I ran the -- a comparison with the 20 forced-air warming and without, and I also -- if I 21 recall correctly, I ran a case where I had a even 22 higher temperature coming out of the Bair Hugger than 23 is reasonable. 24 So I ran other cases for the journal paper. 25 Q. Okay. When you say "a higher temperature,"</p>	<p style="text-align: right;">Page 65</p> <p>1 Q. And when you're talking about a time step 2 are you like running it every second, every two 3 seconds, every five seconds? 4 A. You -- It's like that, but you use -- you 5 can use different time steps during your calculation. 6 So, for example, you might want to use small time 7 steps initially to get things going, and then you 8 might use larger time steps, let's say, once you get 9 to quasi steady and you want to go out further in time 10 just to verify. So you can change the time step over 11 ti -- over -- over -- during the calculation. But 12 unless you do that, the time step is the same between 13 each sequential time. 14 Q. So is it a second, a fraction of a second? 15 A. It would be a fraction of a second. 16 Q. And did you ever change the time steps? 17 A. Yes. 18 Q. At what point? 19 A. What do you mean by "at what point"? 20 Q. Like when did -- 21 Did you change the time step between 1 and 22 264? 23 A. I don't recall. 24 Q. Where would that information be? 25 A. I don't know if I recorded that. I don't</p>

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<p style="text-align: right;">Page 66</p> <p>1 recall recording when I changed -- when or if I 2 changed time steps. 3 Q. So you don't know even if you changed the 4 time step. 5 A. I -- 6 You know, thinking back, I do recall 7 changing the time step, but I don't recall when. 8 Q. You do understand that all the opinions you 9 intend to offer in this case had to be disclosed to 10 the plaintiff by June 2nd, 2017. 11 MR. GOSS: Object to form, foundation. 12 Q. Were you aware of a deadline for your expert 13 opinion in this case? Your report? 14 A. Yes, I was. 15 Q. Okay. And the deadline was June 2nd, 2017? 16 A. That sounds -- 17 Q. Okay. 18 A. -- right. 19 Q. And you prepared the report yourself? 20 A. Yes. 21 Q. Okay. Did anyone provide any edits to the 22 report? 23 A. Yes. 24 Q. Who? 25 A. Counsel would have provided typographical</p>	<p style="text-align: right;">Page 68</p> <p>1 report for publication. 2 A. Yes. 3 Q. Okay. Because you would need the time step 4 to reproduce the results. 5 A. Correct. 6 Q. Okay. Do you agree with me that there is a 7 lot more information in your journal article than is 8 contained in your expert report? Scientific 9 information? 10 A. No. 11 Q. "No"? 12 A. No. 13 Q. Okay. Without the time step can I reproduce 14 your results? 15 A. Yes. 16 Q. But you just told me it was very important 17 to reproduce the results. 18 A. Correct. 19 Q. So without it and it's an important piece of 20 information to reproduce results, how would I 21 reproduce your results without a time step? 22 A. And actually let me clarify my earlier 23 answer. 24 Provided that your time step is sufficiently 25 small and that it allows you to reach quasi-steady</p>
<p style="text-align: right;">Page 67</p> <p>1 edits; commas, periods. Nothing substantive, nothing 2 that would change the conclusions or any substance of 3 the report. 4 Q. Any of your colleagues look at it and offer 5 any edits? 6 A. No. 7 Q. Okay. When was the journal article 8 submitted? 9 A. I would estimate -- estimate April or May. 10 Q. Of this year? 11 A. Yes. 12 Q. Okay. Did you put the time step in the 13 journal? 14 A. I would have to look. I don't know. 15 Q. Okay. If you do change the time step during 16 a -- a run, is that something that you would disclose 17 in the methodology of a journal paper? 18 A. The choice of time step is important to 19 disclose, and its bearing on accuracy, but whether or 20 not you change it may or may not be important. 21 Q. So you definitely would have disclosed, 22 like, the -- that the -- Strike that. 23 The time step is an important piece of 24 information that is usually submitted as a part of a 25 CFD analysis in a scientific -- scientific research</p>	<p style="text-align: right;">Page 69</p> <p>1 results, you would be able to reproduce these results. 2 Q. Okay. But if I wanted to -- I guess for -- 3 to create file 264 again, I would need the time step 4 that you used; correct? 5 A. No. 6 Q. Well how would I know that 264 correlates to 7 the time step you used without knowing your time step? 8 A. Well first of all, the TRN file that I 9 provided has my time steps. Okay? 10 Q. Okay. 11 A. Secondly, the number 264 isn't important by 12 itself. What's important -- And this is the same with 13 Dr. Elghobashi's work. What's important is that you 14 run the results long enough so that there's not 15 meaningful change. And so you could repre -- 16 reproduce the quasi-steady results without knowing the 17 time step that I used. 18 Q. And I understand what you're saying, but my 19 question's a little bit more specific, okay? 20 I assume that every single time step, okay, 21 has numbers in it that -- that identify the results of 22 the calculations for a different part of the mesh; 23 correct? 24 A. Correct. 25 Q. Okay. So if I wanted to run a CFD model and</p>

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<p style="text-align: right;">Page 70</p> <p>1 obtain the same numbers in the 264th time step, I 2 would need to know what time step you used; correct? 3 A. That is correct, but that's not relevant. 4 Q. I understand that. It might not be 5 relevant, but my statement is correct. 6 A. Yes. 7 Q. Okay. And I would have to know, like, where 8 you started kind of; right? 9 A. Correct. 10 Q. I mean, is that called the boundary 11 conditions or is it called something else where you 12 start? 13 A. Where you start is called the initial 14 condition. 15 Q. Okay. Are the initial conditions anywhere 16 in your report? 17 A. No. 18 Q. Okay. Do you have it in any type of your 19 notes? 20 A. No. 21 Q. Is it anywhere that I could obtain it 22 sitting here today? 23 A. No. And it's not relevant. 24 Q. Okay. I understand that you say it's not 25 relevant, but that's kind of a legal term. So let's</p>	<p style="text-align: right;">Page 72</p> <p>1 A. You're using the word "replicate" in a way 2 that's not the way it's used in our field. To 3 replicate, and I mentioned this before, "replicate" 4 doesn't mean to do the exact same thing with the exact 5 same methodology, but it's to come up with the same 6 results and conclusions. You are able -- Anyone is 7 able to replicate my work simply from that TRN file. 8 Now that doesn't mean that at the 264th time step they 9 will have the exact same numbers, but it means that if 10 they do the problem right they will come to the exact 11 same conclusions. 12 Q. And I understand that, and I understand 13 exactly what you're saying, sir. And I -- And I know 14 you think some of my questions don't mean anything or 15 are not relevant, but what I'm really just trying to 16 find out is this. I cannot replicate the same numbers 17 in 264 unless I have the initial -- the initial 18 conditions; correct? 19 A. That is correct. 20 Q. Okay. 21 A. And I just want to correct your 22 interpretation of my answer. 23 Can I ask for your answer to be -- your 24 response to be read back? 25 Q. Well you can talk to your counsel and he</p>
<p style="text-align: right;">Page 71</p> <p>1 stick the relevancy objections to your counsel and 2 just answer my questions for me. 3 MR. GOSS: Well I think "relevance" has a 4 meaning outside of the law, and if that's the way 5 he's using it, then -- 6 MR. ASSAAD: Fair enough. 7 MR. GOSS: -- let him use it. 8 BY MR. ASSAAD: 9 Q. But I would need those initial conditions to 10 do the exact same thing that you did to get the 11 results that are obtained in the TRN file that you've 12 provided; correct? 13 A. That is a correct statement. 14 Q. Okay. And I'd also have to know whether or 15 not you changed the time step between the initial 16 conditions and time step 264; correct? 17 A. Correct. 18 Q. Okay. Otherwise, without those data -- that 19 data, it would be impossible for me to replicate the 20 results you found in your 264 TRN file; correct? 21 A. I disagree. 22 Q. How would I replicate and get the exact same 23 numbers -- I'm not talking about your judgment -- I'm 24 talking about the exact same calculated numbers in the 25 264 TRN file, if I don't have the initial conditions?</p>	<p style="text-align: right;">Page 73</p> <p>1 could ask -- he can correct anything later on when he 2 has a chance to ask. 3 A. Okay. Well then I'll do it from memory. 4 It's not that I disagree with your question, 5 it's that you're using the word "replicate" in a way 6 that is not used in this field. You're -- Maybe 7 you're using "replicate" with a legal meaning, but 8 that's not -- when we talk about can you replicate 9 someone's study we are not talking -- we're not using 10 the word replicate as you've done. That's my 11 clarification. 12 Q. And I understand that, because there could 13 be a different methodology or a different initial 14 conditions; correct? 15 A. Correct. 16 Q. But my question is more just simple math. 17 To get the calculated numbers in the 264 18 TRN, I would need to know what the initial conditions 19 are; correct? 20 A. That is correct. 21 Q. Okay. Now for the 254 TRN file did you use 22 RANS or LES? 23 A. I used LES, which is Large-Eddy Simulation. 24 Q. Okay. Did you ever use RANS initially? 25 A. Yes.</p>

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<p style="text-align: right;">Page 74</p> <p>1 Q. And was that to create your initial 2 conditions? 3 A. Yes. 4 Q. Okay. What was showed in Science Day, was 5 that a RANS model or an LES model? 6 A. LES. 7 Q. Okay. And you ran RANS once, correct, to 8 get your initial conditions? 9 A. I believe that's true. 10 Q. And RANS is steady state? 11 A. RANS does not have to be steady state. 12 Q. Did you run it steady state? 13 A. I would have run it steady state. 14 Q. Okay. And my understanding is that you used 15 the, according to your report, the Boussinesq 16 approximation? 17 A. That's right. And I'm going to try to spell 18 that. 19 Q. We can -- We can give the spellings later 20 on to her. I don't want to waste time with spelling. 21 A. Thank you. 22 Q. Okay. And on the -- 23 And just so I understand, did you use RANS 24 or LES for the 2540? 25 A. LES.</p>	<p style="text-align: right;">Page 76</p> <p>1 any way? 2 A. Yes. 3 Q. How did you change the geometry? 4 A. I omitted small and insignificant objects, I 5 don't recall which ones. But as an example, let's say 6 I want to simulate the airflow in this room. There 7 are many small features which may not matter, like the 8 doorknob, the handle on the cup -- the cupboard over 9 there. Those features that are small that don't 10 affect the flow I would have -- I removed some of 11 them. 12 Q. Okay. And that'd just be a judgment call 13 what you believe would affect or not affect the 14 airflow. 15 A. That is correct. 16 Q. Okay. Based on your education, training and 17 experience. 18 A. That is correct. 19 Q. Okay. And did the geometry already contain 20 a grid or a mesh? 21 A. No. 22 Q. Okay. Is a grid and mesh the same thing? 23 A. Yes. 24 Q. Okay. Now what program was used to create 25 the mesh?</p>
<p style="text-align: right;">Page 75</p> <p>1 Q. Okay. And you also used the Boussinesq for 2 the 2540? 3 A. Correct. 4 Q. And so you received a geometry, a CAD file 5 from the lawyers for 3M. 6 A. Correct. 7 Q. Okay. And those are not the lawyers of 8 Blackwell Burke, but Greenberg Traurig; correct? 9 A. Correct. 10 Q. Were you aware why -- why Greenberg Traurig 11 was not -- no longer attorneys for 3M? 12 A. No. 13 Q. Okay. And you don't know who created the 14 geometry; correct? 15 A. Correct. 16 Q. Do you know what software they used? 17 A. No. 18 Q. Okay. And I take it you just imported it 19 into whatever system that you use. 20 A. Correct. 21 Q. And that would be ANSYS? 22 A. Correct. 23 Q. ANSYS CFX or ANSYS Fluent? 24 A. We used ANSYS CFX. 25 Q. Okay. And did you change the geometry in</p>	<p style="text-align: right;">Page 77</p> <p>1 A. The ANSYS mesher. 2 Q. And what shapes were used to create the 3 mesh? 4 A. The vast majority, perhaps all of the shapes 5 were tetrahedral. 6 Q. Okay. 7 A. Pyramid -- Pyramid-like shapes. 8 Q. Okay. Four-sided trian -- 9 Four sides of triangles; correct? 10 A. Or five sides. 11 Q. Or five sides. I'm sorry. You're right, 12 five sides. 13 A. Well it's four or five, it's a combination. 14 Q. Okay. 15 A. Pyramids and tetrahedrons are two 16 complimentary shapes; one of them has five sides, one 17 has four sides. 18 Q. Okay. So tetrahedral could either be four 19 or five sides? 20 A. No. We use the term tetrahedral for four 21 sided, and that's what "tetra" comes from. We use 22 pyramidal or pyramid elements in our field generally 23 refers to five-sided. 24 Q. Okay. So you believe that all the mesh 25 shapes were tetrahedral?</p>

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<p style="text-align: right;">Page 78</p> <p>1 A. Or pyra -- 2 Or pyramids. 3 Q. Okay. Is that something that you've written 4 down? 5 A. No. 6 Q. How would I find that out? 7 A. From the TRN file. 8 Q. Okay. And what -- 9 Do you know what CFX solves for; does it 10 solve for the different shapes, or does it kind of say 11 it's all one shape? 12 A. I don't quite know how to interpret your 13 question. 14 Q. Well did you use any -- 15 I guess what's the term polyhedra with 16 respect to CFX; does that mean anything? 17 A. Polyhedra would refer to a multi-sided 18 element. 19 Q. Okay. Does CFX solve for polyhedras? 20 A. Well polyhedra means a multi-sided object. 21 Q. Okay. 22 A. CFX will solve for brick-shaped elements, 23 which have eight sides; it will solve for hexahedras, 24 which have six sides. They can have -- It'll solve 25 for wedge elements which have five; pyramid elements</p>	<p style="text-align: right;">Page 80</p> <p>1 Q. Okay. 2 A. So I used the meshers contained in the ANSYS 3 software, but there are other meshers I could have 4 used. 5 Q. Does it create its own file after it's done? 6 A. Yes. 7 Q. Where is that file? 8 A. It's -- 9 The mesh is contained within the TRN. 10 Q. But does it create a separate file after you 11 mesh? 12 A. It would create a separate file after the 13 mesh. 14 Q. And where is that file? 15 A. I don't think I have it because it's 16 contained within the TRN. 17 Q. I understand that, but you run the mesh and 18 I -- you just said it creates its own separate file; 19 correct? 20 A. That's right. 21 Q. That's before you probably run any of the 22 calculations; correct? 23 A. That's correct. 24 Q. Did you delete that meshing file? 25 A. I would have to look to see if I have it,</p>
<p style="text-align: right;">Page 79</p> <p>1 which have five; and tetrahedras, which have five. 2 Q. Okay. 3 A. Or, I'm sorry, four. 4 Q. Okay. And I know you -- in your journal 5 article you looked at the 505 as well? 6 A. Yes. 7 Q. And did you use the same geometry in the 505 8 as you did with the 750? 9 A. Yes. 10 Q. Okay. So I assume you still have the 11 geometry someplace. 12 A. That's correct. 13 Q. Did you pull that geometry from the 505 -- 14 that you used in the 505 from the TRN file, the 264? 15 A. Yes. 16 Q. So you don't have the original geometry file 17 that was given to you by the lawyers for 3M. 18 A. I don't know. I may. I would have to look. 19 Q. Okay. So you said something about ANSYS 20 mesher. Is that the only meshing program that you 21 could use in ANSYS? 22 A. No. 23 Q. Why did you decide to use ANSYS mesher? 24 A. Well the meshing program in ANSYS actually 25 has many different meshers.</p>	<p style="text-align: right;">Page 81</p> <p>1 but once you have the TRN file you don't need -- you 2 don't need the mesh file, so there's no reason to keep 3 it. 4 Q. Okay. Okay. So whether or not you kept it 5 or not is irrelevant because you have it in the TRN 6 file. 7 A. That is correct. 8 Q. Okay. Does CFX put out any other files 9 besides a TRN file? 10 A. Yes. 11 Q. What files? 12 A. It puts out an output file which is just a 13 script of what you've done, which is the same as -- 14 it's all contained in the TRN. And it puts out what's 15 called a RES file, which is the results, which is also 16 the same as the TRN. 17 Q. Okay. Do you have those files? 18 A. No. Well I may have the output file, which 19 is a script file, but the results file are the same as 20 the TRN. 21 Q. Okay. So what's the output file, does that 22 contain your initial conditions? 23 A. It -- I don't know. 24 Q. So it may? 25 A. Well, I mean, it -- it does -- it --</p>

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<p style="text-align: right;">Page 82</p> <p>1 Well let me say this. It does not contain 2 the initial conditions. It's a script file. It's 3 just writing of the setup of your problem. 4 Q. But wouldn't the setup have the initial 5 conditions? 6 A. No, because it's just the script. So, for 7 example, it says you're using air, you're using the 8 LES method, your density is this, your velocity is 9 this. 10 Q. Okay. 11 A. So it's information written to a script, but 12 it's not data. 13 Q. Okay. And you said there was a results file 14 but you don't have that any more; correct? 15 A. Correct, because it's contained within the 16 TRN. 17 Q. Okay. Any other files? 18 A. Not that I can think of. 19 Q. I mean, does CFX put a CFX file out? 20 A. Yeah. Actually there are two more files, 21 thanks for reminding me. 22 There could be a CFX file, and what's called 23 a DEF file, definition file. Both of those are 24 contained within the TRN. 25 Q. Okay. But they're al -- they're also</p>	<p style="text-align: right;">Page 84</p> <p>1 A. The -- I have used computers at the 2 University of Minnesota. 3 Q. I mean for this. For this. 4 A. For this I did not. 5 Q. Okay. 6 (Abraham Exhibit 6 marked for 7 identification.) 8 BY MR. ASSAAD: 9 Q. What's been marked as Exhibit 6 is a 10 document that was produced to us during the first 11 subpoena issued to you, titled Abraham 00002 regarding 12 your job information. 13 Do you recall this document? 14 A. Yes. 15 Q. What is this document? 16 A. This document lists the -- it's information 17 about the run and the subdivision of elements or -- 18 the subdivision of the problem to processors or to 19 cores. 20 Q. Engineering Sparrow, what's that? 21 A. It's a name of a computer. 22 Q. That you use at St. Thomas? 23 A. Correct. 24 Q. And the reason why I'm confused is because 25 you trained under Sparrow; correct?</p>
<p style="text-align: right;">Page 83</p> <p>1 separate files as well. 2 A. That's correct. 3 Q. Do you still have those files, or have they 4 been deleted? 5 A. I don't believe I still have them because 6 they're contained within the TRN. 7 Q. And are these files on your personal 8 computer, or on a server in St. Thomas? 9 A. They would be on a computer at St. Thomas. 10 Q. On the server? 11 A. Well they're on a desktop. 12 Q. Okay. And what computer did you use to run 13 the CFX, or the -- the model? 14 A. I used a multicore desktop machine. 15 Q. How many cores? 16 A. I recall 16. 17 Q. Sixteen cores? 18 A. Yep. 19 Q. Did you consider using a supercomputer? 20 A. No. 21 Q. What about a computer at the University of 22 Minnesota? 23 A. I did not consider that. 24 Q. So you never used a computer at the 25 University of Minnesota?</p>	<p style="text-align: right;">Page 85</p> <p>1 A. That's correct. 2 Q. Okay. So this is not his computer? 3 A. That is correct. 4 Q. Okay. So you used no resources from the 5 University of Minnesota. 6 A. Correct. 7 Q. Okay. And where it says "mesh," are these 8 mesh or nodes? Or do you know what that even is? 9 A. I know what that is. 10 Q. What is it? 11 A. When you want to solve a problem, let's say 12 fluid flow in this room, the problem is very complex 13 and the mathematics is very difficult so what is done 14 is you subdivide the room into a number of -- 15 Q. Parts? 16 A. I'd say parts, and there are these 17 tetrahedra, pyramid, hexahedra, these elements that we 18 were talking about. 19 Q. Umm-hmm? 20 A. Those are cells. We call that the mesh. 21 At the intersection of those cells where two 22 come together we call that a node. And so cells and 23 nodes, or mesh and nodes are used together. 24 Q. So this isn't the mesh size, this is 25 probably the nodes size?</p>

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<p style="text-align: right;">Page 86</p> <p>1 A. I don't know if these numbers refer to the 2 number of elements or the number of nodes. 3 Q. Well I add these up and they're roughly 4 between 1.8 to 1.9 million. I assume your mesh was 5 larger than 1.9 million. 6 A. Correct. 7 Q. Okay. Do you know how many nodes you had? 8 A. The re -- 9 All the results contained here are about 8.1 10 million elements. I don't know the number of nodes, 11 but it would be approximately that number. 12 Q. The same -- 13 The nodes equal elements? 14 A. No. 15 Q. Close to the elements? 16 A. Close. 17 Q. Okay. Then how would I know this 8.1 18 million? 19 A. From the TRN file. 20 Q. Did you have another -- 21 Do you have another one of these Job 22 Information tables for the RANS model that you ran? 23 A. I don't believe so. I can go look when I 24 get to my computer, but I don't recall. I don't 25 believe so.</p>	<p style="text-align: right;">Page 88</p> <p>1 beginning of the run, and I recall 40 days, then yes, 2 the result would have been obtained aft -- 40 days 3 later. 4 But I don't know where in the calculation 5 this run -- this start run corresponds to. So it 6 could have been the initial start, it could have been 7 after a hundred time steps, it could have been after 8 200, so I -- I can't tell you, sitting here, what time 9 step this start run corresponds to. I just don't 10 recall. 11 Q. So this -- this is performed for every time 12 step? 13 A. No. 14 Q. Okay. So sitting here today, you're not 15 sure of when you started the -- the run. 16 A. Correct. 17 Q. Okay. The fact that the contract was 18 signed, or the proposal with St. Thomas and 3M was 19 October 17th, 2015, does that give you -- does that 20 refresh your recollection as how long it took you to, 21 I guess, import the geometry, do the mesh or do 22 whatever you had to do before you started the run? 23 A. No. 24 Q. How long did it take you to create the mesh? 25 A. I don't recall.</p>
<p style="text-align: right;">Page 87</p> <p>1 Q. And, I'm sorry, you said you had 16 cores? 2 A. Correct. 3 Q. Is it a double or single precision? 4 A. Well the cores aren't double precision, 5 they're single precision. 6 Q. Did you monitor the solutions as they 7 solved? 8 A. Yes. 9 Q. How long did it take to solve? 10 A. I recall something like 40 days. 11 Q. Forty days? 12 A. Correct. 13 Q. Nonstop running? 14 A. Correct. 15 Q. So when did you start the solution? Would 16 it be this date, November 18th, 2015? 17 A. Well certainly -- 18 It appears that that is the date. 19 Q. Okay. So that's the start time. 20 A. Yes. 21 Q. Okay. So you would have not gotten the 22 solution till the middle of December? 23 A. You know, I think I -- I'm struggling with 24 memory. I'm trying to remember the details of the 25 length. If the run starting on November 18th was the</p>	<p style="text-align: right;">Page 89</p> <p>1 Q. Was it a day, an hour? 2 A. It would have been more than an hour, likely 3 more than a day. 4 Q. Okay. By the way, do you have authority to 5 sign contracts between St. Thomas and third parties? 6 A. I am one of the signers. 7 Q. And who is the other signer? 8 A. There are other folks in the administration. 9 I think the Dean would sign, and then there may be 10 someone else. 11 Q. Okay. I take it that you've reviewed Dr. 12 Settles' report; correct? 13 A. Yes. 14 Q. And you reviewed Dr. Kuehn's report from 15 University of Minnesota. 16 A. Yes. 17 Q. Have you ever had any classes with Dr. 18 Kuehn? 19 A. Yes. 20 Q. When you were an undergrad? 21 A. That's correct. 22 Q. What class? 23 A. It -- And I think I was an undergrad, it's 24 possible I was studying my mas -- getting my master's 25 degree. But I recall taking a class from him related</p>

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<p style="text-align: right;">Page 90</p> <p>1 to heating, ventilation and air conditioning. 2 Q. Okay. Did you rely on Dr. Settles' report 3 for any information? 4 A. No. 5 Q. Did you rely on Dr. Kuehn's report for any 6 information? 7 A. I relied on Dr. Kuehn's report to confirm my 8 results. 9 Q. And what did you look at Dr. Kuehn's report? 10 A. His velocity and temperature measurements. 11 Q. Okay. Did you read his deposition? 12 A. Yes. 13 Q. Okay. The entire dep -- 14 You read the entire deposition? 15 A. Yes. 16 Q. Did you read Dr. Settles' deposition? 17 A. Yes. 18 Q. Did you read any other depositions? 19 A. Yes. 20 Q. What other depositions did you read? 21 A. I read all of the depositions from the 22 plaintiff's side. 23 Q. Plaintiffs' experts, or plaintiff's side? 24 A. Plaintiffs' experts. 25 Q. Okay.</p>	<p style="text-align: right;">Page 92</p> <p>1 You read Dr. Settles and Dr. Kuehn; correct? 2 A. That's correct. 3 Q. You've read Dr. Elghobashi; correct? 4 A. Correct. 5 Q. Have you read Michael Buck? 6 A. No. 7 Q. Have you read Dr. -- or Dan Koenigshofer? 8 A. The only deposition -- And thank you so much 9 for correcting me. 10 The only deposition on the plaintiff's side 11 that I've read is Elghobashi. 12 Q. Okay. So you've seen all the reports of 13 plaintiffs' experts, you just have only read the 14 Elghobashi deposition. 15 A. That is correct. 16 Q. Have you received any other depositions of 17 plaintiffs' experts? 18 A. No. 19 Q. Okay. Have you read the depositions of 20 defense experts? 21 A. Just the -- 22 Just Settles and Kuehn. 23 Q. Okay. And Kuehn is K-U-E-H-N, that Kuehn; 24 correct? 25 A. Correct.</p>
<p style="text-align: right;">Page 91</p> <p>1 A. Okay. 2 Q. So that would have been Dr. Elghobashi? 3 A. That's right. I read his. 4 Q. Okay. Doctor -- Or Dan Koenigshofer? 5 A. Yes. 6 Q. Michael Buck? 7 A. I -- I'm struggling to go through -- to 8 remember the names, but there were perha -- maybe make 9 this easier. There are maybe eight or nine or so 10 expert depositions that I was provided, and I read all 11 of them. I recall -- I think I recall the name 12 Michael Buck. 13 Q. Okay. 14 A. Certainly Dan K. 15 Q. Umm-hmm. 16 A. Certainly Said Elghobashi. 17 Q. Okay. Well I will represent to you that the 18 plaintiffs only have seven experts, and not all of 19 them have been deposed. So -- So are there -- are you 20 mixing expert reports and depositions? 21 A. That's actually possible. Maybe -- I think 22 I am mixing expert reports and depositions. 23 Q. Okay. 24 A. Thank you for correcting me. 25 Q. So what depositions have you read?</p>	<p style="text-align: right;">Page 93</p> <p>1 Q. Okay. Have you read Michael Keen's 2 deposition, Keen from Cali -- or from Canada? 3 A. No. 4 Q. Okay. Have you reviewed any expert reports 5 by the defense? 6 A. I don't think so. 7 Q. Well you've seen Gary Settles' report; 8 correct? 9 A. Correct. 10 Q. Okay. And you've -- you've seen Dr. Kuehn's 11 report. 12 A. That is correct. 13 Q. Okay. 14 MR. GOSS: Do you mean American Kuehn? 15 MR. ASSAAD: American Kuehn. 16 MR. GOSS: Thank you. 17 Q. Okay. 18 A. Correct. 19 Q. Have you seen any other of defense expert 20 reports? 21 A. I have defense expert reports. I have only 22 read the two that we just mentioned. 23 Q. So you haven't read the report -- the expert 24 report of Jim Ho. 25 A. Correct.</p>

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<p style="text-align: right;">Page 94</p> <p>1 Q. You haven't read the report of Michael Keen 2 from Canada. 3 A. Correct. 4 Q. You haven't read the report of Dr. Mont. 5 A. Correct. 6 Q. You haven't read the report of Dr. Holford? 7 Holford. 8 A. Correct. 9 Q. You haven't read the report of Dr. Borak. 10 A. Correct. 11 Q. You haven't read the report of Dr. Wenzel; 12 correct? 13 A. Correct. 14 Q. And you haven't read the expert report of 15 Dr. Lampotang; correct? 16 A. Correct. 17 Q. You haven't read the report of Dr. 18 Hannenberg; correct? 19 A. Correct. 20 Q. Have you read the deposition of Al Van 21 Duren? 22 A. I have read a deposition of Al Van Duren. 23 Q. Which one; do you recall? 24 A. It was in maybe September 2015. So I have 25 read a deposition around that time.</p>	<p style="text-align: right;">Page 96</p> <p>1 Thank you for correcting me. 2 Q. Okay. Did you have any criticisms of Dr. 3 Kuehn's report? 4 A. No. 5 Q. Any criticism of Dr. Settles' report? 6 A. No. 7 Q. You have no criticism of -- of his 8 measurement of air coming out of the Bair Hugger 9 between 30 to 33 degrees Celsius? 10 A. No. 11 Q. Okay. Now my understanding is is that the 12 invoices with respect to your expert work for 3M the 13 money goes directly to you; correct? 14 A. Yes. 15 Q. Okay. And the two CFD studies for research, 16 which is for the 750 and the 505, is money that goes 17 to St. Thomas; correct? 18 A. That's correct. 19 Q. Okay. So the \$15,000 in your CV for 20 research in 2017 for 3M is for the 505; correct? 21 A. Can you point to me where you're seeing 22 15,000? 23 Q. I'm sorry. Fourteen thousand. My fault. 24 A. That is correct. 25 Q. Okay. And you've kept invoices</p>
<p style="text-align: right;">Page 95</p> <p>1 Q. So you read the deposition that was done in 2 the Walton case, or the Johnson case. 3 A. I don't know about the cases. 4 Q. Okay. 5 A. I read a deposition from Al Van Duren around 6 September 2015. 7 Q. Okay. Any other depositions you've read of 8 fact witnesses? 9 A. Yes. 10 Q. Who? 11 A. Gary Hansen. 12 Q. Okay. 13 A. And Winston Tan. 14 Q. Okay. And was that back while Greenberg 15 Traurig was the representative of 3M? 16 A. Yes. 17 Q. Okay. So would it be fair to say that if 18 this MDL started in January of 2 -- December of 2015 19 that you haven't read any fact depositions that were 20 conducted in the MDL? 21 A. Sitting here now, I cannot think of any fact 22 dep -- witness depositions that I have read after the 23 MDL. 24 Q. Okay. After the beginning of the MDL. 25 A. After the beginning of the MDL.</p>	<p style="text-align: right;">Page 97</p> <p>1 contemporaneously with your work in this case; 2 correct? 3 A. Correct. 4 Q. Your invoices are complete; correct? 5 A. I -- Yes. 6 Q. And they're accurate; correct? 7 A. To the best of my knowledge. 8 Q. And they're so accurate that some months you 9 even submitted invoices that you had no time; correct? 10 A. That is correct. 11 Q. Okay. And even for the cost of travel you 12 -- you put it to the exact penny; correct? 13 A. I think I'm obligated to, but yes. 14 Q. I mean, you're an engineer, you like to be 15 accurate; correct? 16 A. I certainly don't want to overcharge someone 17 for work. 18 Q. So with respect to your invoices, and -- 19 Do you have a copy of your invoices today? 20 A. No. 21 Q. Okay. Were you told to bring nothing to 22 this deposition? 23 A. No. 24 Q. You just decided to bring nothing to this 25 deposition?</p>

25 (Pages 94 to 97)

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<p style="text-align: right;">Page 98</p> <p>1 A. That's not true.</p> <p>2 Q. Okay. Well what did you bring to this</p> <p>3 deposition?</p> <p>4 A. I have some files right here, some papers</p> <p>5 right here.</p> <p>6 Q. Oh, I didn't see those. I'm sorry.</p> <p>7 MR. ASSAAD: Let's take a break.</p> <p>8 THE REPORTER: Off the record, please.</p> <p>9 (Recess taken from 11:39 to 11:45 a.m.)</p> <p>10 BY MR. ASSAAD:</p> <p>11 Q. We were talking about your invoices. Would</p> <p>12 it be fair to say if I want to determine all the time</p> <p>13 you worked on your report that was completed by early</p> <p>14 January, I'd just have to look at your invoices?</p> <p>15 A. No.</p> <p>16 Q. Let me guess. I'm assuming that's because</p> <p>17 of the flat fee for the -- actually doing the CFD that</p> <p>18 was paid to St. Thomas; correct?</p> <p>19 A. Well that's -- that is one reason, but also</p> <p>20 I tend not to -- I tend to undercharge. So, for</p> <p>21 example, I don't charge for many phone calls, and for</p> <p>22 travel, and so I tend to undercharge. It would be the</p> <p>23 lower bound of the work. It's the charged amount.</p> <p>24 Q. Okay. Because I looked at it, and by the</p> <p>25 ti -- by the end of January you've only billed 30</p>	<p style="text-align: right;">Page 100</p> <p>1 Do you recall, back in 2016, what protocol</p> <p>2 that would be for?</p> <p>3 A. No, I don't recall.</p> <p>4 Q. Okay. Did you speak with any of the defense</p> <p>5 experts?</p> <p>6 A. No.</p> <p>7 Q. So you never spoke to Gary Settles or --</p> <p>8 A. And in fact --</p> <p>9 Can I correct that?</p> <p>10 Q. Yes.</p> <p>11 A. At Science Day there were some defense</p> <p>12 experts there along with myself.</p> <p>13 Q. Fair enough.</p> <p>14 A. Outside of that I have not spoken to any</p> <p>15 defense experts.</p> <p>16 Q. Okay. Oh, by the way, that protocol, if it</p> <p>17 was in December of 2016, that would not -- that would</p> <p>18 not apply to your CFD analysis in your report;</p> <p>19 correct?</p> <p>20 A. Correct.</p> <p>21 Q. Okay. Are you a member of the American</p> <p>22 Society of Mechanical Engineers?</p> <p>23 A. No.</p> <p>24 Q. Were you ever a member?</p> <p>25 A. Yes.</p>
<p style="text-align: right;">Page 99</p> <p>1 hours. Does that seem about roughly how much time you</p> <p>2 spent, personal time that you charged directly to 3M</p> <p>3 on the -- your research and the report writing?</p> <p>4 A. That seems reasonable.</p> <p>5 Q. Okay. And I might have misspoke, but that</p> <p>6 was the beginning of 2016, correct, that you completed</p> <p>7 the report?</p> <p>8 A. That's how I in --</p> <p>9 Q. Okay.</p> <p>10 A. Well that's how I interpreted what your</p> <p>11 question was.</p> <p>12 Q. Okay. All right.</p> <p>13 A. But I think you said completed the report by</p> <p>14 2 -- early 2016?</p> <p>15 Q. Just the CFD portion.</p> <p>16 A. Okay.</p> <p>17 Q. That's what I meant.</p> <p>18 There's one thing I want to discuss if you</p> <p>19 know off the top of your head, but you spent about six</p> <p>20 hours to draft the protocol that's listed on your</p> <p>21 invoices. Do you know what that's referring to?</p> <p>22 A. Can you show me which invoice?</p> <p>23 Q. It was in December of 2016 and, I'm sorry, I</p> <p>24 misquoted, it was three hours to draft -- discussion</p> <p>25 of CFD and protocol and draft protocol.</p>	<p style="text-align: right;">Page 101</p> <p>1 Q. Why are you no longer a member?</p> <p>2 A. The American Society of Mechanical Engineers</p> <p>3 is a professional society where my understanding is if</p> <p>4 you pay your annual fee you become a member, and there</p> <p>5 wasn't much value in it for me, so I dropped</p> <p>6 membership.</p> <p>7 Q. Okay. But at one time you were a member;</p> <p>8 correct?</p> <p>9 A. I recall being a member.</p> <p>10 Q. And at one time, you agree with me that</p> <p>11 while you went to the University of Minnesota you took</p> <p>12 a course on engineering ethics; correct?</p> <p>13 A. I don't believe I did.</p> <p>14 Q. Was -- Did any of your course involve -- any</p> <p>15 of your studies involve engineering ethics?</p> <p>16 A. I don't recall taking any course on</p> <p>17 engineering ethics or a course that had a significant</p> <p>18 part of engineering ethics. I can't remember --</p> <p>19 Sitting here right now I cannot remember any</p> <p>20 engineering ethics content in a course.</p> <p>21 Q. Well do you agree that engineers uphold and</p> <p>22 advance the integrity, honor and dignity of the</p> <p>23 engineering profession?</p> <p>24 A. They should.</p> <p>25 Q. Do you agree that engineers should be</p>

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<p style="text-align: right;">Page 102</p> <p>1 objective -- should be objective?</p> <p>2 A. Yes.</p> <p>3 Q. Should be honest?</p> <p>4 A. Yes.</p> <p>5 Q. And have integrity?</p> <p>6 A. Yes.</p> <p>7 Q. Do you agree that the engineers of 3M should</p> <p>8 be held to the same standards?</p> <p>9 A. Yes.</p> <p>10 Q. Do you agree that engineers must use their</p> <p>11 knowledge and skill for enhancement of human welfare?</p> <p>12 A. Yes.</p> <p>13 Q. Do you agree that safety should be</p> <p>14 considered in the engineering profession, the safety</p> <p>15 of humans?</p> <p>16 A. Yes.</p> <p>17 Q. And safety is paramount?</p> <p>18 A. Well safety should be considered, should be</p> <p>19 highly considered. I don't know about "paramount,"</p> <p>20 but safety should be highly considered.</p> <p>21 Q. Do you believe that in the context of</p> <p>22 designing a device to be used by the public that</p> <p>23 safety is more important than profits?</p> <p>24 MR. GOSS: Object to form.</p> <p>25 A. Yes.</p>	<p style="text-align: right;">Page 104</p> <p>1 Conduct apply to you?</p> <p>2 A. I don't know.</p> <p>3 Q. Okay.</p> <p>4 (Abraham Exhibit 7 marked for</p> <p>5 identification.)</p> <p>6 BY MR. ASSAAD:</p> <p>7 Q. I'd like for you to turn to page 4 of 6.</p> <p>8 Under Section VII it states: "Members of the</p> <p>9 University community must transact University business</p> <p>10 in compliance with applicable laws, regulations, and</p> <p>11 University" policy -- "policies and procedures."</p> <p>12 A. Can you tell me where you're reading?</p> <p>13 Q. Under Section VII, first sentence.</p> <p>14 A. I'm reading "All University financial</p> <p>15 transactions and reports, including tax returns," and</p> <p>16 so forth.</p> <p>17 Q. On page 4?</p> <p>18 A. Page 4 of 6?</p> <p>19 Q. Under Section VII, number --</p> <p>20 A. Oh, Section VII. Sorry. My -- My mistake.</p> <p>21 (Witness reviewing exhibit.) Yes.</p> <p>22 Q. Actually let's go to the first page, "POLICY</p> <p>23 STATEMENT." It states: "The University of St. Thomas</p> <p>24 is committed to upholding the highest ethical</p> <p>25 standards in all that it does and expects those who</p>
<p style="text-align: right;">Page 103</p> <p>1 Q. Engineering's a profession; correct? Not</p> <p>2 just a job.</p> <p>3 A. Correct.</p> <p>4 Q. Okay. And as a professor you have a duty to</p> <p>5 teach ethical engineering behavior; correct?</p> <p>6 A. If we have a class where that fits, then</p> <p>7 yes. But we have a duty to convey ethical behavior to</p> <p>8 our students.</p> <p>9 Q. Okay. Engineers are to serve with the</p> <p>10 fidelity -- with fidelity to the public; correct?</p> <p>11 A. Is "fidelity" truthfulness? What is</p> <p>12 "fidelity"?</p> <p>13 Q. It's the quality of being faithful or loyal.</p> <p>14 A. I don't know if engineers have to be loyal</p> <p>15 to the public.</p> <p>16 Q. Okay.</p> <p>17 A. That's not a word I would use.</p> <p>18 Q. Are you familiar with the St. Thomas Code of</p> <p>19 Ethics?</p> <p>20 A. I am familiar with it.</p> <p>21 Q. Have you read them recently?</p> <p>22 A. No.</p> <p>23 MR. GOSS: I'm just going to state my usual</p> <p>24 objection to ethics as an improper subject matter.</p> <p>25 Q. Did the St. Thomas Code of Professional</p>	<p style="text-align: right;">Page 105</p> <p>1 are part of the University community, including</p> <p>2 trustees, officers, faculty, staff, and students to</p> <p>3 adhere to such standards in their business dealings."</p> <p>4 Did I read that correctly?</p> <p>5 A. Yes.</p> <p>6 Q. Would you agree with me that this Code of</p> <p>7 Professional Conduct applies to you?</p> <p>8 A. Yes.</p> <p>9 Q. Okay. And you would agree with me that even</p> <p>10 in your work as a consultant, as a professor of</p> <p>11 engineering at the University of St. Thomas the Codes</p> <p>12 of Professional Conduct listed out here apply to you.</p> <p>13 A. I don't know if that's technically true, but</p> <p>14 I would view them as applying to me.</p> <p>15 Q. Okay. Under Section VI -- I'm sorry,</p> <p>16 Section VII, the last sentence says: "Therefore, only</p> <p>17 individuals who have been delegated proper authority</p> <p>18 by an appropriate University official are authorized</p> <p>19 to enter into contractual agreements on behalf of the</p> <p>20 University."</p> <p>21 See where I read that?</p> <p>22 MR. GOSS: Are you under one of the subs?</p> <p>23 MR. ASSAAD: VII a., under "Contractual</p> <p>24 Obligations."</p> <p>25 MR. GOSS: Okay.</p>

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<p style="text-align: right;">Page 106</p> <p>1 A. Yes.</p> <p>2 Q. Are you --</p> <p>3 Have you been delegated proper authority to</p> <p>4 contract -- or enter into contractual agreements on</p> <p>5 behalf of the university?</p> <p>6 A. Well I'm one of a number of people that is</p> <p>7 able to enter into contractual obligations. I by -- I</p> <p>8 don't believe I, by myself, can.</p> <p>9 Q. Okay. So you yourself can't go out and</p> <p>10 enter in a contract on behalf of the University</p> <p>11 without someone else from the University involved.</p> <p>12 A. That's my understanding.</p> <p>13 Q. Okay. Are any professors allowed to do</p> <p>14 that?</p> <p>15 A. I don't know of any professors that are</p> <p>16 allowed to do that.</p> <p>17 Q. Okay. Who else at St. Thomas approved the</p> <p>18 research with regard to the proposal with 3M?</p> <p>19 A. The proposals would run through the Dean and</p> <p>20 then the grant's office.</p> <p>21 Q. So if I subpoena the University of St.</p> <p>22 Thomas, I'll see documents signed by the Dean and the</p> <p>23 grant office with respect to approving this contract?</p> <p>24 A. I expect you would.</p> <p>25 Q. Okay. You agree that engineers should solve</p>	<p style="text-align: right;">Page 108</p> <p>1 significance of a problem, you can't ignore the</p> <p>2 problem. You have to identify the problem and look at</p> <p>3 it.</p> <p>4 A. Identifying the problem is different from</p> <p>5 acting on or ignoring a problem.</p> <p>6 Q. Okay.</p> <p>7 A. So I'm try -- I'm parsing your words.</p> <p>8 Let me use this cup as an example.</p> <p>9 Underneath this cup there is a small indentation,</p> <p>10 which is by design. Let's say that this cup comes off</p> <p>11 of -- By the way, it's a very nice cup. Let's say the</p> <p>12 cup comes of the assembly line and there's a problem</p> <p>13 with the manufacturing and the indentation is 10</p> <p>14 percent too large. That's a problem that someone may</p> <p>15 or may not identify and they may or may not act on it,</p> <p>16 so -- because it may not matter.</p> <p>17 So the point I'm trying to distinguish is</p> <p>18 identifying a problem, and then making a decision to</p> <p>19 act on it are two different things.</p> <p>20 Q. Okay. You agree, in any event, that</p> <p>21 problems involving patient risks should not be</p> <p>22 ignored.</p> <p>23 A. It depends.</p> <p>24 Q. Okay.</p> <p>25 A. And let me --</p>
<p style="text-align: right;">Page 107</p> <p>1 a potential problem instead of ignoring it?</p> <p>2 A. Possibly.</p> <p>3 Q. Engineers that are working in the community,</p> <p>4 not --</p> <p>5 A. Possibly. Not always.</p> <p>6 Q. Okay. So it's okay if -- if you're an</p> <p>7 engineer that has a product on the market and you</p> <p>8 identify a potential problem, to ignore it?</p> <p>9 MR. GOSS: Object to form,</p> <p>10 mischaracterizes.</p> <p>11 A. That's -- It -- It's --</p> <p>12 I would take it on a case-by-case basis.</p> <p>13 There are some problems that are insignificant that</p> <p>14 you can ignore, and there are some problems that may</p> <p>15 be significant that you should not ignore.</p> <p>16 Q. Well to determine whether or not the problem</p> <p>17 is significant or insignificant you have to identify</p> <p>18 the problem and determine whether or not it is</p> <p>19 significant or insignificant; correct?</p> <p>20 A. Correct.</p> <p>21 Q. So you might ignore moving on with respect</p> <p>22 to a problem, but the identification of a problem you</p> <p>23 would not ignore.</p> <p>24 A. Could you rephrase that question?</p> <p>25 Q. Well to determine whether -- the</p>	<p style="text-align: right;">Page 109</p> <p>1 Q. No. That's fine. I mean I --</p> <p>2 That's fine.</p> <p>3 A. Well by just saying -- by cutting me off I</p> <p>4 am not able to fully qualify my answer, and I think</p> <p>5 that the record won't be clear.</p> <p>6 Q. Well I'll withdraw my question then. Let's</p> <p>7 move on.</p> <p>8 So you're familiar with the 35 bridge</p> <p>9 collapse here in Minneapolis; correct?</p> <p>10 A. Yes.</p> <p>11 Q. Did you ever go over the bridge?</p> <p>12 A. Yes.</p> <p>13 Q. How often did you go over that bridge?</p> <p>14 A. One to three times per week.</p> <p>15 Q. Is it on your way home? At that time.</p> <p>16 A. Can you remind me what year it was?</p> <p>17 Q. 2007.</p> <p>18 A. It would not have been on my way home.</p> <p>19 Q. So why would you go over it one or two ti --</p> <p>20 three times a week?</p> <p>21 A. It's a major bridge in South St. Paul, and I</p> <p>22 live in sou -- South Minneapolis, and I live in South</p> <p>23 Minneapolis, so I'm estimating that I might go over it</p> <p>24 one to three times a week.</p> <p>25 MR. GOSS: If you went to Home Depot you</p>

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<p style="text-align: right;">Page 110</p> <p>1 probably went over it.</p> <p>2 A. There is a Home Depot, there's also a</p> <p>3 Target. Going downtown.</p> <p>4 Q. But you didn't go over it every day;</p> <p>5 correct?</p> <p>6 A. Correct. I did not go over it every day.</p> <p>7 Q. You understand that in the 3M -- or in the</p> <p>8 Minnesota bridge collapse that engineers or the city</p> <p>9 ignored problems identified by the engineer.</p> <p>10 MR. GOSS: Objection, lack of foundation.</p> <p>11 Q. Are you aware of that?</p> <p>12 A. That's not totally true.</p> <p>13 Q. Okay. There weren't engineers that said</p> <p>14 that we should replace the bridge and there's</p> <p>15 structural problems with the bridge and just to</p> <p>16 monit -- and the city said just to monitor it instead</p> <p>17 of fixing it?</p> <p>18 A. So I have to break that apart. First of</p> <p>19 all, any warnings related to the bridge collapse I</p> <p>20 think were associated with the questions about the</p> <p>21 strength of the gusset plates.</p> <p>22 Q. Yes.</p> <p>23 A. There were other warnings about the bridge</p> <p>24 that the city took action on. In fact, as I recall,</p> <p>25 they had annual remediation processes to maintain the</p>	<p style="text-align: right;">Page 112</p> <p>1 Q. Okay. Have you looked at any other</p> <p>2 patient-warming devices manufactured by 3M or Arizant</p> <p>3 prior to the 505 model or the 750 model?</p> <p>4 A. Yes.</p> <p>5 Q. What model?</p> <p>6 A. I don't recall. I worked on patient warming</p> <p>7 with Augustine Medical at the time, back in 2000. I</p> <p>8 don't recall the model numbers that we worked with.</p> <p>9 Q. Do you recall any model numbers that warned</p> <p>10 about possible airborne contamination?</p> <p>11 A. No.</p> <p>12 Q. Would that be relevant to --</p> <p>13 Would that knowledge be relevant to your</p> <p>14 report?</p> <p>15 A. I would need to see more. I doubt it would</p> <p>16 be relevant.</p> <p>17 Q. Okay. When you worked with Augustine, what</p> <p>18 did you do for Augustine?</p> <p>19 A. I worked on characterizing the rate of heat</p> <p>20 transfer from the blanket to a patient and the flow</p> <p>21 and temperatures within the blanket.</p> <p>22 Q. Okay. Did you publish anything regarding</p> <p>23 that work?</p> <p>24 A. No.</p> <p>25 Q. Do you still have the data or information</p>
<p style="text-align: right;">Page 111</p> <p>1 structural integrity of the bridge. So the city did</p> <p>2 take action on warnings from engineers.</p> <p>3 Now I don't recall if a specific warning</p> <p>4 came about from the gusset-plate issue. If the city</p> <p>5 decided not to fix the problem but to monitor it, that</p> <p>6 is still taking action. It may not have been</p> <p>7 appropriate action, but it still is taking action.</p> <p>8 So it's not a simple yes-or-no answer that I</p> <p>9 can give there.</p> <p>10 Q. Okay. But at the end of the day the bridge</p> <p>11 collapsed.</p> <p>12 A. At the end of the day, the bridge collapsed.</p> <p>13 Q. Okay. Just by the way, did you receive any</p> <p>14 --</p> <p>15 Well do you recall some of the engineers</p> <p>16 stated, in the bridge collapse, that a catastrophic</p> <p>17 collapse was possible?</p> <p>18 A. Boy, sitting here now I cannot recall. That</p> <p>19 may have occurred.</p> <p>20 Q. By the way, did you receive any -- did you</p> <p>21 look at the Sessler study?</p> <p>22 A. Yes.</p> <p>23 Q. Were you provided the raw data regarding the</p> <p>24 Sessler study?</p> <p>25 A. No.</p>	<p style="text-align: right;">Page 113</p> <p>1 regarding that work?</p> <p>2 A. No.</p> <p>3 Q. So you've met Dr. Augustine before; correct?</p> <p>4 A. I have.</p> <p>5 Q. Okay. When was the last time you spoke with</p> <p>6 Dr. Augustine?</p> <p>7 A. To my best recollection, and mind you this</p> <p>8 is years, I think I met him at Augustine Medical.</p> <p>9 There was a social gathering or a party, and I believe</p> <p>10 I met him there, and I also met him after he left</p> <p>11 Augustine Medical. He moved to a nearby location and</p> <p>12 he had started a company, and I recall meeting him</p> <p>13 there.</p> <p>14 Q. Did you do for --</p> <p>15 Did you do any work for him after -- after</p> <p>16 he started his -- after he left Augustine Medical or</p> <p>17 Arizant?</p> <p>18 A. No.</p> <p>19 Q. Okay. Have you spoken with him or anyone</p> <p>20 from Augustine Medical since that time, since the last</p> <p>21 conversation, by email or telephone?</p> <p>22 A. Well Augustine Medical is no longer around,</p> <p>23 right? Oh, oh. You mean Augustine -- Augustine --</p> <p>24 Q. Biomedical or --</p> <p>25 A. Okay.</p>

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<p style="text-align: right;">Page 114</p> <p>1 Q. Any Augustine entity. 2 A. No. 3 Q. Okay. So you haven't heard from Randy 4 Benham or anyone else in the past five years? 5 A. I don't know Randy Benham. I don't recall 6 ever hearing from him. I did receive a subpoena, 7 which I don't think was from Randy Benham, but it's 8 possible it was. 9 Q. Okay. 10 A. But I have never spoken to him. I don't 11 recall any speaking or emails. 12 Q. Now Exhibit 2 is your CV; correct? We 13 already went over that. 14 A. Yes. 15 Q. Okay. Are you certified in any way by 16 ANSYS? Like a certified ANSYS technician or anything 17 like that? 18 A. No. 19 Q. Okay. What's your training in ANSYS? 20 A. I've taken a number of courses with ANSYS at 21 the undergraduate and graduate level. I've taken a 22 large number of short training seminars on ANSYS 23 premises, and I -- 24 Q. ANSYS what? 25 A. Premises.</p>	<p style="text-align: right;">Page 116</p> <p>1 currently? 2 A. Version 18. 3 Q. Okay. But what version was the CFD done for 4 the 750? 5 A. 17. 6 Q. 17, or 17.1? 7 A. I don't know if it was 17.0 or .1. 8 Q. Would there be a difference in the results 9 if it was 17 or 17.1? 10 A. No. 11 Q. Okay. You're not an expert in medicine; 12 correct? 13 A. Correct. 14 Q. You're not an infectious disease expert; 15 correct? 16 A. Correct. 17 Q. So do you know how many CFUs it would take 18 to cause a periprosthetic joint infection? 19 A. No. 20 Q. You're not an expert in orthopedics; 21 correct? 22 A. Correct. 23 Q. You're not an expert in nursing; correct? 24 A. Correct. 25 Q. You're not an expert in filter</p>
<p style="text-align: right;">Page 115</p> <p>1 Q. Okay. 2 A. Both in Minneapolis and in a place called 3 Canonsburg, Pennsylvania. 4 Q. What's "ANSYS premises"? 5 A. Their locations. 6 Q. Oh, okay. 7 A. Their buildings. 8 Q. Okay. 9 MR. GOSS: Another legal term. 10 MR. ASSAAD: I thought it was a software 11 bundle, -- 12 THE WITNESS: Sorry. 13 MR. ASSAAD: -- you know, so -- 14 A. Thank you for helping clarify that. 15 And I've used ANSYS as an instructor and a 16 researcher throughout my career. 17 Q. Okay. And is this ANSYS CFX or ANSYS 18 Fluent? 19 A. We have both. 20 Q. But which one do you use? 21 A. I have used both. I currently use CFX more 22 often. 23 Q. And St. Thomas has both? 24 A. Correct. 25 Q. And what version does St. Thomas have</p>	<p style="text-align: right;">Page 117</p> <p>1 manufacturing; correct? 2 A. Correct. 3 Q. You're not an expert in medical device 4 design; correct? 5 A. Well I've designed many medical devices and 6 I've worked for many medical companies. I haven't 7 been asked, in this case, to serve as a medical device 8 design expert, so I'd have to give that some thought. 9 Q. Okay. But at this point you don't consider 10 yourself a medical device design expert for this case. 11 A. Correct. 12 Q. And would you hold yourself out as a patient 13 warmer medical device expert? 14 A. Yes. 15 Q. You would? 16 A. Yes. 17 Q. You have designed the patient-warming 18 devices? 19 A. I have worked on the design of multiple 20 patient-warming devices. 21 Q. Which ones? 22 A. I've worked on a device from Smiths Medical. 23 Q. Called? 24 A. It's a -- I don't know. It's EQ -- I think 25 the name is an EQ something, so it's numbers and</p>

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<p style="text-align: right;">Page 118</p> <p>1 letters.</p> <p>2 Q. Okay.</p> <p>3 A. I have published that work.</p> <p>4 Q. Okay.</p> <p>5 A. I have worked on the -- I think it's called</p> <p>6 the Ranger fluid warming system.</p> <p>7 Q. Okay.</p> <p>8 A. I have worked on the forced-air warming</p> <p>9 devices through Augustine Medical.</p> <p>10 Q. Okay.</p> <p>11 A. And I have analyzed multiple forced-air</p> <p>12 warming devices.</p> <p>13 Q. Have you worked on any other patient-warming</p> <p>14 devices besides forced-air warming?</p> <p>15 A. Yes.</p> <p>16 Q. Which ones?</p> <p>17 A. The Ranger.</p> <p>18 Q. Okay. That's a fluid warmer; correct?</p> <p>19 A. Correct.</p> <p>20 Q. Okay.</p> <p>21 A. But it warms fluids before they're inserted</p> <p>22 into the body, so it's essentially a patient warmer.</p> <p>23 Q. Fair enough.</p> <p>24 And have you used -- have you done any</p> <p>25 research on conductive blankets or conductive devices?</p>	<p style="text-align: right;">Page 120</p> <p>1 Q. Okay. Like some --</p> <p>2 Like, for example, forced-air warming is</p> <p>3 going to transfer heat by both convection and</p> <p>4 conduction; correct?</p> <p>5 A. Well it's really convection.</p> <p>6 Q. Well would you agree with me that any part</p> <p>7 that the blanket is touching the body it's going to</p> <p>8 transfer heat by conduction?</p> <p>9 A. I would agree that there would be</p> <p>10 conduction, but the vast majority of heat is</p> <p>11 transferred by convection.</p> <p>12 Q. And -- And the -- the amount of heat I'm not</p> <p>13 really going to get into, but there is some conductive</p> <p>14 transfer when the Bair Hugger is used, Bair Hugger</p> <p>15 blanket.</p> <p>16 A. There is no conduction heat transfer that</p> <p>17 does not also involve convection.</p> <p>18 Q. Okay.</p> <p>19 A. Would you like me to explain?</p> <p>20 Q. I understand what you're saying, actually,</p> <p>21 so that's fine.</p> <p>22 Is there any radiation transfer of energy</p> <p>23 using the Bair Hugger?</p> <p>24 A. There -- It's the same answer for</p> <p>25 conduction. There would be some radiation, but it's</p>
<p style="text-align: right;">Page 119</p> <p>1 A. Yes, I have done research on conductive</p> <p>2 devices.</p> <p>3 Q. Okay. What conductive devices?</p> <p>4 A. In my research, almost every heat transfer</p> <p>5 situation has conduction.</p> <p>6 Q. I'm talking dealing with patient warming.</p> <p>7 A. Oh. Thanks for the clarification.</p> <p>8 No. I have not done work on conductive</p> <p>9 warming devices.</p> <p>10 Q. Okay. You agree with me that the</p> <p>11 patient-warming devices are either going to transfer</p> <p>12 heat by either convection, conduction or radiation;</p> <p>13 correct?</p> <p>14 A. I agree.</p> <p>15 Q. Those are the only three ways of heat</p> <p>16 transfer that I'm aware of. Is that --</p> <p>17 Are there any other ways to do heat</p> <p>18 transfer?</p> <p>19 A. You could have internal heat generation, but</p> <p>20 that -- I can't imagine that being used for a</p> <p>21 patient-warming device.</p> <p>22 Q. Okay. So you agree there's multiple</p> <p>23 patient-warming devices out there, but just a</p> <p>24 different method of transferring heat.</p> <p>25 A. I agree.</p>	<p style="text-align: right;">Page 121</p> <p>1 initially caused by convection.</p> <p>2 Q. Okay. Well... That's fine.</p> <p>3 You're not an expert with respect to medical</p> <p>4 device warnings; correct?</p> <p>5 A. Did you say "warnings" or --</p> <p>6 Q. Warnings. Warnings.</p> <p>7 A. Correct. I am not.</p> <p>8 Q. You're not an expert on operating room</p> <p>9 design.</p> <p>10 A. That is correct.</p> <p>11 Q. Besides doing the operating-room airflow in</p> <p>12 this case, and the 505 I guess, have you done any</p> <p>13 other work on operating-room airflow?</p> <p>14 A. Yes.</p> <p>15 Q. Where?</p> <p>16 A. I worked for a company called Precision Air</p> <p>17 I think is their name, it was not a formal -- there</p> <p>18 was no formal grant, but I -- I have done work and</p> <p>19 informal consulting with them, and they design</p> <p>20 operating-room airflow systems.</p> <p>21 Q. Okay. So besides Precision Air and this</p> <p>22 case, you have not worked on any operating-room</p> <p>23 airflow systems.</p> <p>24 A. That's correct.</p> <p>25 Q. Do you hold yourself out as an expert in</p>

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<p style="text-align: right;">Page 122</p> <p>1 designing HVAC systems for operating rooms?</p> <p>2 A. I do not.</p> <p>3 Q. Okay. The airflow system that is used in an</p> <p>4 operating room, would you consider that laminar or</p> <p>5 turbulent?</p> <p>6 A. I consider all airflow in all operating</p> <p>7 rooms turbulent because I'm using the fluid mechanics</p> <p>8 definition of turbulence.</p> <p>9 Q. Which is the Reynolds number; correct?</p> <p>10 A. It's based in part on the Reynolds number.</p> <p>11 Q. Do you know what the Reynolds number is for</p> <p>12 the operating room that you used with respect to your</p> <p>13 CFD analysis?</p> <p>14 A. Can you clarify when you say "for the</p> <p>15 operating room" used.</p> <p>16 Q. Like for the CFD model it has airflow;</p> <p>17 correct?</p> <p>18 A. Correct.</p> <p>19 Q. And that is going to have a Reynolds number;</p> <p>20 correct?</p> <p>21 A. No.</p> <p>22 Q. It's not going to have a Reynolds number?</p> <p>23 A. No.</p> <p>24 Q. What's the Reynolds number based off of?</p> <p>25 A. The Reynolds number is based off of flows</p>	<p style="text-align: right;">Page 124</p> <p>1 Q. Okay. So you don't know what it is sitting</p> <p>2 today -- sitting here today?</p> <p>3 A. I don't know what it is, and it's not</p> <p>4 material, and I could calculate it in a matter of a</p> <p>5 few minutes.</p> <p>6 Q. Okay. Do you consider your -- yourself an</p> <p>7 expert in particle flow?</p> <p>8 A. Yes.</p> <p>9 Q. Do you consider yourself an expert in</p> <p>10 particle movement in a turbulent flow?</p> <p>11 A. Well I've done multiple studies on movement</p> <p>12 of objects and particles in a turbulent flow, so --</p> <p>13 and multiple peer-reviewed studies. Does that make me</p> <p>14 an expert? I don't know. I'd have to think about</p> <p>15 that.</p> <p>16 Q. Well sitting here today, I mean, I</p> <p>17 understand you want to think about it, but I need a</p> <p>18 answer.</p> <p>19 A. I consider myself an expert.</p> <p>20 Q. Okay. Are you familiar with the</p> <p>21 Navier-Stokes equations?</p> <p>22 A. Yes.</p> <p>23 Q. Are you familiar with the Boussinesq</p> <p>24 approximation equations?</p> <p>25 A. Yes.</p>
<p style="text-align: right;">Page 123</p> <p>1 that have a defined velocity, a defined length of --</p> <p>2 of an object they're flowing around or flowing</p> <p>3 through, like a duct, and a viscosity.</p> <p>4 Now for example in this room, if the camera</p> <p>5 would pan up -- please don't pan up -- but if it did</p> <p>6 pan up or pan around we would see ventilation.</p> <p>7 Perhaps this screen in the ceiling's a ventilation.</p> <p>8 We can define a Reynolds number up there within that</p> <p>9 ventilation shaft. But when the Reynolds number --</p> <p>10 when the flow gets into this room there's really no</p> <p>11 unique definition of the Reynolds number because</p> <p>12 there's no unique length. Do we use the length that's</p> <p>13 the height of the ceiling? Do we use the length</p> <p>14 that's the width of this room, according to my</p> <p>15 perspective? Do we use what's called the depth? Do</p> <p>16 we use the length, let's say, the diameter or height</p> <p>17 of this coffee cup? There's no unique definition.</p> <p>18 Q. Okay.</p> <p>19 A. So we -- it is very unusual --</p> <p>20 I have never heard of someone defining a</p> <p>21 Reynolds number for a room.</p> <p>22 Q. What about the Reynolds number of the</p> <p>23 ventilation right before it comes out of the vent, did</p> <p>24 you calculate that?</p> <p>25 A. No.</p>	<p style="text-align: right;">Page 125</p> <p>1 Q. You agree that turbulence does not follow</p> <p>2 airstreams.</p> <p>3 A. Turbul -- Well turbulence is a description</p> <p>4 of air motion.</p> <p>5 Q. Yes.</p> <p>6 A. So turbulence is not something that follows</p> <p>7 anything.</p> <p>8 Q. Okay. And that's my point, it doesn't</p> <p>9 follow airstreams.</p> <p>10 If it's not following anything, it's</p> <p>11 definitely not following airstreams.</p> <p>12 A. Well, I mean, fluid that is turbulent that</p> <p>13 moves would carry its turbulence with it, but it's not</p> <p>14 -- someone wouldn't say turbulence follows an</p> <p>15 airstream.</p> <p>16 Q. Okay. Just out of curiosity, on all your --</p> <p>17 I see a lot of consulting work here, and have you</p> <p>18 always used ANSYS?</p> <p>19 A. No.</p> <p>20 Q. What did you use -- What other --</p> <p>21 What other software device -- or software</p> <p>22 programs do you use?</p> <p>23 A. I've written my own code, first of all. And</p> <p>24 I did use Fluent before they were part of ANSYS.</p> <p>25 Q. Okay.</p>

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<p style="text-align: right;">Page 126</p> <p>1 A. And now I strictly use ANSYS. 2 Q. Do you ever use your own code? 3 A. No. 4 Q. Have you used your co -- 5 Has your code been verified? 6 A. I don't recall because it was years ago. 7 Q. Okay. And you know the difference between 8 verification and validation; correct? 9 A. Yes, I do. 10 Q. Okay. Have you used your code in any of the 11 consulting work you've done that's listed in your CV? 12 A. No, I don't believe I have. No. 13 Q. Okay. Now all -- all this, like for -- 14 would it be fair to say that going from page -- from 15 the "grants" section on page 5, all the way down for 6 16 and 7 and 8, 9, page 9, all those grants, did you 17 primarily use either ANSYS Fluent or ANSYS CFX? 18 A. Well many of those grants didn't involve 19 CFD. 20 Q. Okay. But the ones that did? 21 A. Yes. 22 Q. Okay. You didn't use any of your code for 23 any of those grants. 24 A. That is correct. 25 Q. Okay. And the ANSYS that was used, if I</p>	<p style="text-align: right;">Page 128</p> <p>1 Q. Okay. What's a research -- 2 I mean, but does it have the same 3 capabilities of, like, what you could buy from ANSYS? 4 A. I believe it does. 5 Q. Does it have any limitations of how many -- 6 like how big of a mesh it would calculate, or -- 7 A. I don't think the research license has any 8 limitations. If that's important, I could check. 9 But sitting here now I think the research 10 license has all of the capabilities. 11 Q. Okay. With respect to the, say, for 12 example, the \$12,000 given to St. Thomas, do you 13 receive any money from that? 14 A. Yes. 15 Q. What percentage? 16 A. I probably received approximately half of 17 that. I would have to check. 18 Q. Okay. And with respect to most of the 19 consulting work that you -- or grants that you have 20 listed in your CV, would it be about the same 21 percentage? 22 A. No. 23 Q. What would be the difference? Is it a case 24 by case? 25 A. It's case by case.</p>
<p style="text-align: right;">Page 127</p> <p>1 wanted to know the version that was used could I just 2 look at what version was being used by the University 3 at the time? 4 A. Yes. 5 Q. Have you ever used the ANSYS at the 6 University of Minnesota since you left The University 7 of Minnesota? 8 A. Yes. 9 Q. In what capacity? 10 A. I was an Associate Fellow at the 11 Supercomputing Institute at the University of 12 Minnesota for a number of years, and my research group 13 would have used ANSYS stored there. 14 Q. Okay. Do you own ANSYS? 15 A. No. 16 Q. Okay. So whatever you use is what the 17 University has. 18 A. Correct. 19 Q. Okay. And is -- 20 I mean, does the University have a full 21 version of ANSYS? 22 A. We have a -- what's called a research 23 license. 24 Q. Okay. 25 A. We also have student licenses.</p>	<p style="text-align: right;">Page 129</p> <p>1 Q. But would you agree with me that on some of 2 them you do receive compensation? 3 A. Yes. 4 Q. Okay. Like, for example, you did something 5 in 2015 for Mador Technologies, M-A-D-O-R. You got 6 \$20,000. Did you receive any personal, like, 7 compensation? 8 A. I did not. 9 Q. Okay. What about Amphora Medical of 10 fifty-five thousand point five -- 55.5 thousand; did 11 you receive any compensation? 12 A. Yes. 13 Q. What percentage of that was direct 14 compensation to you? 15 A. I would estimate I received 10 to 15,000. 16 Q. Okay. Windstrip, LLC. Do you recall doing 17 work for them? 18 A. Yes. 19 Q. And it was 250,000 for development of 20 vertical axis wind turbines? 21 A. Yes. 22 Q. Did you receive any personal compensation 23 directly for you? 24 A. Four thousand dollars. 25 Q. Four thousand?</p>

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<p style="text-align: right;">Page 130</p> <p>1 A. Correct.</p> <p>2 Q. And that's not an estimate?</p> <p>3 A. That is exact.</p> <p>4 Q. Okay. Most of -- These -- Most -- Well,</p> <p>5 strike that.</p> <p>6 With respect to a lot of these grants, are</p> <p>7 these grants that you've obtained while working at St.</p> <p>8 Thomas or The University of Minnesota, or did you work</p> <p>9 with somebody else that obtained the grants?</p> <p>10 Do you understand the question?</p> <p>11 A. No.</p> <p>12 Q. For example, with 3M it was you that was the</p> <p>13 person that worked with 3M and obtained the grant for</p> <p>14 St. Thomas. You understand that; correct?</p> <p>15 A. Yes.</p> <p>16 Q. With respect to these other grants, were you</p> <p>17 the direct contact with The University of St. Thomas</p> <p>18 or University of Minnesota, or was this -- you're just</p> <p>19 itemizing grants that were received by St. Thomas or</p> <p>20 The University of Minnesota that you worked on?</p> <p>21 A. For the vast majority of them I was the --</p> <p>22 Q. Okay.</p> <p>23 A. -- primary contact and recipient.</p> <p>24 Q. Are you familiar with the ANSYS User's</p> <p>25 Guide?</p>	<p style="text-align: right;">Page 132</p> <p>1 everything that matters needs to be accounted for?</p> <p>2 A. Everything that --</p> <p>3 Things that can significantly affect the</p> <p>4 results --</p> <p>5 Q. Okay.</p> <p>6 A. -- need to be accounted for.</p> <p>7 Q. All right. So, for example, in your</p> <p>8 assumptions you determined what you would consider</p> <p>9 significant that could affect the results and not</p> <p>10 affect the results; correct?</p> <p>11 A. Yes.</p> <p>12 Q. For example, you -- you removed some</p> <p>13 geometry because when you were creating -- when you</p> <p>14 were -- you assumed, based on your education, training</p> <p>15 and experience, that that geometry would have no</p> <p>16 effect on the results, or very little effect.</p> <p>17 A. Correct.</p> <p>18 Q. So your assumptions -- you make assumptions</p> <p>19 about what would affect or not affect the model.</p> <p>20 A. Yes.</p> <p>21 Q. Okay. So you'd agree with me that if a heat</p> <p>22 source would affect the model significantly, that</p> <p>23 needs to be included in a model.</p> <p>24 A. If it would affect the question you're</p> <p>25 trying to answer, then yes.</p>
<p style="text-align: right;">Page 131</p> <p>1 A. Yes.</p> <p>2 Q. Do you agree with me that it's authoritative</p> <p>3 on how to use ANSYS and its capabilities?</p> <p>4 A. I don't know -- I don't know if I'd use -- I</p> <p>5 don't know if I'd ever use the word "authoritative."</p> <p>6 I would agree that it describes how to use ANSYS, and</p> <p>7 its capabilities.</p> <p>8 Q. Okay. You agree with me that the</p> <p>9 programmers of ANSYS would probably know more about</p> <p>10 ANSYS's capabilities than you do.</p> <p>11 A. In general, yes. I might know more about</p> <p>12 some small feature.</p> <p>13 Q. Okay. Now I assume that you are aware of</p> <p>14 the basic laws of physics.</p> <p>15 A. Yes.</p> <p>16 Q. Okay. You agree with me that in a case such</p> <p>17 as this the law of thermodynamics applies.</p> <p>18 A. Yes.</p> <p>19 Q. Okay. And with respect to a complex model,</p> <p>20 which this is, as you described earlier, everything</p> <p>21 needs to be accounted for; correct?</p> <p>22 A. I disagree.</p> <p>23 Q. Okay. Why?</p> <p>24 A. Not everything matters.</p> <p>25 Q. Okay. Would you agree with me that</p>	<p style="text-align: right;">Page 133</p> <p>1 Q. Okay. And let's just agree that when I say</p> <p>2 "the problem," or "the model," we're talking about the</p> <p>3 ques -- you're creating a model to answer a question.</p> <p>4 A. Correct.</p> <p>5 Q. Okay. So you agree with me that if people</p> <p>6 would significantly affect the model, they should be</p> <p>7 included.</p> <p>8 A. Yes.</p> <p>9 Q. Okay. You agree with me that the inlets and</p> <p>10 outlets of a room should be included if it would</p> <p>11 significantly affect the model.</p> <p>12 A. Yes.</p> <p>13 Q. Okay. And the goal is to be as accurate as</p> <p>14 possible to put into a model things that may</p> <p>15 significantly affect the results.</p> <p>16 A. Yes.</p> <p>17 Q. You agree with me that if the model is not</p> <p>18 accurate, the model is not reliable.</p> <p>19 A. I would say this: If the model does not</p> <p>20 have the ingredients which are significant and may</p> <p>21 affect the question being asked of the model, then it</p> <p>22 is not reliable.</p> <p>23 Q. Okay. You agree with me that if you use the</p> <p>24 wrong mathematical equations, the model's not</p> <p>25 reliable.</p>

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<p style="text-align: right;">Page 134</p> <p>1 A. Yes.</p> <p>2 Q. By the way, you agree with me that particles</p> <p>3 do not follow airstreams; correct?</p> <p>4 A. They may or may not follow airstreams.</p> <p>5 Q. Depending on the size; correct?</p> <p>6 A. Correct.</p> <p>7 Q. Okay. Because particles have inertia.</p> <p>8 A. That is correct.</p> <p>9 Q. Okay. What size particles follow airstreams</p> <p>10 as compared to size particles that don't follow</p> <p>11 airstreams?</p> <p>12 A. I cannot answer that question in the</p> <p>13 abstract because it depends on the airstreams.</p> <p>14 Q. Okay. In the airstreams in this case --</p> <p>15 with the velocity of the airstreams in this case, do</p> <p>16 you have any idea, sitting here today, what -- what</p> <p>17 size particles would follow the airstreams as compared</p> <p>18 to not follow the airstreams?</p> <p>19 A. No.</p> <p>20 Q. Okay. The fact that we have eight people --</p> <p>21 seven people sitting in this room, does that affect</p> <p>22 the temperature of this room?</p> <p>23 A. It may.</p> <p>24 Q. Okay. But you can't assume that it doesn't.</p> <p>25 A. The reason why I'm pausing is the answer</p>	<p style="text-align: right;">Page 136</p> <p>1 understanding, is you made assumptions with respect to</p> <p>2 your CFD analysis of what would have an effect and not</p> <p>3 have an effect; correct?</p> <p>4 A. No.</p> <p>5 Q. Well there are no people in your CFD</p> <p>6 geometry; correct?</p> <p>7 A. That is correct.</p> <p>8 Q. Except -- Except for the patient.</p> <p>9 A. That's correct.</p> <p>10 Q. So you assumed that the people are not going</p> <p>11 to have effects on the airflow.</p> <p>12 A. No.</p> <p>13 Q. Are they going to have an effect?</p> <p>14 A. People in an OR will have an effect.</p> <p>15 Q. Okay. But you did not put that in your CFD.</p> <p>16 A. That's correct, and there's a reason why.</p> <p>17 Q. Why?</p> <p>18 A. The question I was trying to ans -- ask in</p> <p>19 my CFD model is does the Bair Hugger have the</p> <p>20 potential of disrupting the normal airflow in the</p> <p>21 operating room. Now I could have put people in the</p> <p>22 room, and in fact I could have put moving people in</p> <p>23 the room, but the fact of the matter is, movement</p> <p>24 would dominate any effect the Bair Hugger would have.</p> <p>25 So if there was some kind of motion of air in the</p>
<p style="text-align: right;">Page 135</p> <p>1 involves more than just the presence of eight people,</p> <p>2 it involves the ventilation system and the control</p> <p>3 system. So it's possible, and I would say likely,</p> <p>4 that when more people enter this room the control</p> <p>5 system reacts so that more -- more air, ventilation</p> <p>6 air is supplied. So in that respect it's likely the</p> <p>7 presence of people in this room does not affect the</p> <p>8 temperature.</p> <p>9 Q. Well it's going to affect the temperature to</p> <p>10 a point in which the system reacts to it.</p> <p>11 A. I would agree.</p> <p>12 Q. Okay. So it has an effect on the</p> <p>13 temperature.</p> <p>14 A. I agree, but it's unlikely to have a lasting</p> <p>15 effect.</p> <p>16 Q. Okay. Well we're not talking about -- I'm</p> <p>17 just saying an effect, whether or not it's an</p> <p>18 instantaneous effect. I'm just saying it's going to</p> <p>19 have an effect.</p> <p>20 A. I agree.</p> <p>21 Q. The laws of thermodynamics, we're all</p> <p>22 putting off heat, energy, it's the conservation of</p> <p>23 energy, it's going to have an effect.</p> <p>24 A. That is correct.</p> <p>25 Q. Okay. And you yourself, I think what I'm</p>	<p style="text-align: right;">Page 137</p> <p>1 room, it would likely be from the humans. What I</p> <p>2 wanted to do was isolate the Bair Hugger, in a certain</p> <p>3 sense it's a worst-case scenario. Without any other</p> <p>4 thing that will hide the effect of the Bair Hugger,</p> <p>5 what is the effect of the Bair Hugger.</p> <p>6 Now what I also did, though, is did</p> <p>7 experiments, and in those experiments there were</p> <p>8 people, with heat, moving in a simulated surgery, and</p> <p>9 the results corroborated my calculations.</p> <p>10 Q. When did you do the experiments; before or</p> <p>11 after the CFD?</p> <p>12 A. The experiments would have been done be --</p> <p>13 after. I'm sorry.</p> <p>14 The experiments were done before the CFD</p> <p>15 results.</p> <p>16 Q. Okay. Now you agree with me that it's</p> <p>17 normal to have people in the OR.</p> <p>18 A. I would agree.</p> <p>19 Q. And you agree that -- you've seen videos of</p> <p>20 total hip and total knee surgeries; correct?</p> <p>21 A. I have not seen a complete video of a total</p> <p>22 hip and total knee surgery. I've seen -- So no. The</p> <p>23 answer is no.</p> <p>24 Q. I didn't ask for a complete video, but</p> <p>25 you've seen some videos, at least portions.</p>

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<p style="text-align: right;">Page 138</p> <p>1 A. I've seen portions of videos of either hip 2 or knee re -- surgeries. 3 Q. I mean, you were at Science Day. 4 A. That's right. 5 Q. Okay. So I know you've seen it. 6 A. Well, hold on. But you asked two different 7 types of surgeries, and my recollection is it was just 8 one type. I could be wrong. 9 Q. Okay. 10 A. So I didn't want to overrepresent my video 11 watching. 12 Q. So are you assuming that -- Strike that. 13 You agree that even if you have non-moving 14 people in an operating room it's going to affect 15 airflow. 16 A. Yes. 17 Q. Okay. Especially if the people are around 18 the operating room table it's going to affect the 19 airflow underneath the operating room table. 20 A. I don't know if I agree with that. 21 Q. Well you're -- you're causing -- you are 22 causing blockages underneath the operating room table 23 because you have people standing next to it, correct, 24 and that's going to affect the air underneath the 25 operating room table.</p>	<p style="text-align: right;">Page 140</p> <p>1 What's the term used for how much an object 2 absorbs heat, or -- Is it heat index or heat 3 coefficient? Specific heat. 4 A. Specific heat. 5 Q. That's it, specific heat. 6 Was the specific heat ever -- did you use 7 that at all with respect to your CFD analysis? 8 A. Yes. 9 Q. What -- What did you apply specific heat to? 10 A. The air. 11 Q. Anything else? 12 A. No. 13 Q. What about the blanket, the -- the Bair 14 Hugger blanket? 15 A. I did not apply a specific heat to the Bair 16 Hugger blanket. 17 Q. Okay. 18 A. It was not necessary. 19 Q. What about the drapes? 20 A. Same answer. 21 Q. What about the patient? 22 A. Same answer. 23 Q. So you didn't put -- you didn't apply any 24 specific heat. 25 A. Correct.</p>
<p style="text-align: right;">Page 139</p> <p>1 A. You are causing blockages, but the effect of 2 airflow underneath the operating room because of those 3 blockages would be negligible. 4 Q. Okay. In your CFD model did you -- I 5 remember this from college, because I did very little. 6 I wasn't big when I was in college. 7 Like I remember you could put in, like, 8 material properties, like, for heat transfer and 9 stuff. Was that done in this CFD? 10 A. You can put in material properties for the 11 materials. 12 Q. Yes. 13 A. We wouldn't say put in a material property 14 for heat transfer, because heat transfer doesn't have 15 a property. But it's true, you put in material 16 properties. 17 Q. Well heat transfer is for different objects 18 differently and different materials differently; 19 correct? 20 A. That's correct. 21 Q. And that -- like, for example, in your 22 research when -- because you do a lot of heat 23 transfer; correct? 24 A. Correct. 25 Q. And I -- I can't remem --</p>	<p style="text-align: right;">Page 141</p> <p>1 Q. What about to the walls? 2 A. I did not -- 3 Same answer. 4 Q. Okay. So is it fair to say that the only 5 fluid you applied specific heat to was the air? 6 A. That's the only fluid in the model, so yes. 7 Q. Okay. Well when I took fluid dynamics I was 8 told that everything's a fluid, even solids. 9 A. You were told incorrectly. 10 Q. Okay. They're just different densities. 11 A. You were still told incorrectly. 12 Q. Okay. It was Engineering 101 I guess. 13 MR. GOSS: Kind of wish I'd taken that 14 class. 15 (Laughter.) 16 THE WITNESS: You still can. 17 Q. Were there any solids in your analysis? 18 A. No. 19 Q. So now I'm really confused, because I look 20 at the pictures and there is a operating room table. 21 Is that not a solid? 22 A. No. What you see is the interface between 23 the table and the fluid. You're not seeing inside the 24 operating room table itself. 25 So if I use this table as an example, what</p>

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<p style="text-align: right;">Page 142</p> <p>1 you see is this top interface, but when you look at 2 the model you're not looking at the wood grains 3 inside, and that's the difference. 4 Q. So is it like a void in the model? 5 A. It is a void in the model, but that -- using 6 that term is misleading. 7 Q. I know. I don't know what... 8 Like, for example, I mean it -- there's the 9 table, but it's not really there, it's just telling 10 that, like, it's a barrier type thing. 11 A. That's right. 12 Q. Okay. So -- So you would agree with me that 13 -- 14 What's the word? Is it adiabatic? 15 A. Adiabatic is the word meaning insulated, and 16 I -- I used adiabatic surfaces to represent solids. 17 Q. Okay. Which means that there's no heat 18 transfer among the solids. 19 A. Correct. 20 Q. So you had no heat transfer between the Bair 21 Hugger blanket and the drapes. 22 A. Correct. 23 Q. But we know in the real world that's not 24 accurate. 25 A. In the real world you have cool air on one</p>	<p style="text-align: right;">Page 144</p> <p>1 Q. Oh, was this filmed? 2 A. The -- 3 Q. The experiments? 4 A. The visualization in the OR? 5 Q. Yeah. 6 A. Yes. 7 Q. Okay. Do you know how much film was taken? 8 A. I have no idea. 9 Q. Okay. The two engineers from 3M, do you 10 know who they are? 11 A. I know one of them. 12 Q. Who? 13 A. Andy Chen. 14 Q. Who's Andy Chen? 15 A. An engineer from 3M. 16 Q. Is that how you know him? Did you know him 17 before that day? 18 A. I did know him -- 19 Q. Okay. 20 A. -- before that day. 21 Q. How? 22 A. I think he got his Ph.D. under Sparrow, who 23 was my doctoral advisor. 24 Q. Before or after you? 25 A. After me.</p>
<p style="text-align: right;">Page 143</p> <p>1 side which would cool off the drape. I didn't account 2 for that cool air heat transfer to the drape, nor did 3 I account for heat from any Bair Hugger air to the 4 drape because it wasn't material to my analysis. 5 Q. Okay. Would you agree with me that what was 6 material to your analysis -- Strike that. 7 Did you do the measurements in the OR that 8 account for your geometry? 9 A. No. The measurements were sent to me. I 10 double-checked the width and length of the room, but I 11 did not do other measurements. 12 Q. How many times did you go visit the OR that 13 you modeled? 14 A. Once. 15 Q. And that would have been in 2015? 16 A. Yes. 17 Q. Who was there with you? 18 A. Attorneys, or maybe it was one attorney, I 19 can't recall, from the initial law firm. There were I 20 believe hired surgeons and nurses who replicated a 21 surgery. An attorney from 3M, Janell. Two engineers 22 from 3M. And Jennifer Wagner and Brian Plourde. And 23 I think two lighting people. 24 Q. "Lighting"? 25 A. Or cam -- camera people.</p>	<p style="text-align: right;">Page 145</p> <p>1 Q. Okay. So he's a Ph.D.? 2 A. Yes. 3 Q. And in what, mechanical engineering? 4 A. In mechanical engineering with a specialty 5 in the thermal sciences. 6 Q. Okay. 7 A. Which is heat and fluid flow. 8 Q. Does he do CFD? 9 A. I -- Yes, he does. 10 Q. Okay. Does 3M have the capability of doing 11 their own CFD analysis? 12 A. I believe they do. 13 Q. So why'd they hire you? 14 A. I don't know. 15 Q. They could have done this internally? 16 A. It's possible. 17 Q. Okay. Do you know what soft -- 18 Do they have their own proprietary software, 19 or do they use a commercial product like you? 20 A. I don't -- 21 Sitting here, I don't know the answer to 22 that. 23 Q. Okay. Maybe I should ask this question: 24 Have you seen any CFD models done by 3M? 25 A. No, I have not.</p>

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<p style="text-align: right;">Page 146</p> <p>1 Q. Is there a geometry created for the Bair 2 Hugger blower, or outlet, where the air blows? 3 A. Oh, you have to be more specific. I'm 4 confused. 5 Q. Well, for example, there's geometry for the 6 ventilation of the ducts or the vents; correct? 7 A. Yes. 8 Q. And there's geometry for the intake vents. 9 A. Yes. 10 Q. Now I've seen mixed terms of people calling 11 air coming in as an inlet. I've heard people calling 12 it as an outlet because it's coming out. What term do 13 you use? 14 A. It's an inlet to the room. 15 Q. Okay. Is there a geometry for the Bair 16 Hugger inlet? 17 A. There is a geometry for the Bair Hugger 18 inlet to the room in the sense that the room -- the 19 Bair Hugger air enters into the room. 20 Q. Okay. Is that -- 21 Does it have an area for the geometry? 22 A. Yes. 23 Q. What is the area? 24 A. Sitting here now, I don't know. 25 Q. Could it be --</p>	<p style="text-align: right;">Page 148</p> <p>1 There's a camera above you, so. 2 THE WITNESS: Oh, great. Is it centered? 3 Is it good? 4 (Discussion off the stenographic record.) 5 THE WITNESS: Can you see that? 6 Q. Can I see it, please? 7 A. Yes. (Handing.) 8 Q. Okay. Is it coming from -- 9 Do you know whether or not it's coming from 10 the front of the body or the back of the body? 11 A. Both. 12 Q. Both? Okay. 13 And so if I looked at the TRN file you're 14 absolutely certain it comes out of both? 15 A. Yes. 16 Q. Okay. And what's the -- 17 And you assumed that all the air comes out 18 of the head and neck; correct? 19 A. That is correct. 20 Q. Why did you make that assumption? 21 A. Well there's a number of reasons. First of 22 all, I saw the draping that was done and I saw that 23 the draping channels the airflow so that once it 24 touches the body, once it touches the body the air 25 will migrate vertically upwards and it will exhaust</p>
<p style="text-align: right;">Page 147</p> <p>1 Could you get it from the TRN file? 2 A. Yes. 3 Q. Okay. And how'd you calculate that area? 4 A. It was part of the initial CAD file. 5 Q. Okay. And where is that geometry where the 6 air is coming out? 7 A. Do you mean where in the model is it? 8 Q. Yes. 9 A. It's near the head and neck -- 10 Q. So if we -- 11 A. -- it shows. 12 Q. -- go to your report. Let's go to Exhibit 13 1. What picture would best show me where the air is 14 coming out? 15 And please don't give me the one with all 16 the dot -- dotted lines in it. 17 A. Figure 1(a). 18 Q. Okay. And where is the air coming out? 19 A. Can I mark it up? 20 Q. Yes. Why don't you mark it with a -- 21 Do you have a pen on you? 22 A. No. 23 Q. Use -- 24 [Red pen provided by the court reporter.) 25 MR. ASSAAD: Can we film that, please?</p>	<p style="text-align: right;">Page 149</p> <p>1 near the drape -- near the head and neck. 2 There is also prior literature that's been 3 cited in this case that confirms my understanding that 4 the air enters the room through the head or neck area. 5 In addition, the Bair Hugger has tape on it 6 which adheres the Bair Hugger to the body so in those 7 portions the air can't go elsewhere. And in this case 8 on one side the Bair Hugger was wrapped around the 9 back of the patient so there was no other alternative 10 for it to go. 11 These views were confirmed by Dr. Kuehn's 12 measurements when he took measurements of airflow near 13 the Bair Hugger. 14 Q. Okay. And you're talking about Dr. Kuehn's 15 measurements that when he raised the -- when he turned 16 the Bair Hugger on, the temperature of the room went 17 down? 18 MR. GOSS: Object to form. 19 A. I am not -- 20 I'm not talking about that measurement, and 21 I don't believe that that's a correct characterization 22 of what he did. 23 Q. Have you ever heard the term "junk science"? 24 A. Yes. 25 Q. Okay. Is that a signif -- Is that a --</p>

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<p style="text-align: right;">Page 150</p> <p>1 You made the assumption, based on your 2 analysis, that all the air comes out of the head and 3 neck area; correct? 4 MR. GOSS: Object to form, mischaracterizes 5 the testimony. 6 A. You said "made the assumption based" -- I 7 think you said "based on the analysis." I actually 8 made the determination based on multiple, mutually 9 reinforcing lines of evidence. 10 Q. Okay. But that's an assumption that you 11 made in your CFD analysis; correct? 12 A. That is correct. 13 Q. Okay. If that assumption is incorrect, 14 would you agree with me that your model is incorrect? 15 A. No. 16 Q. Why? 17 A. My model may or may not be incorrect if that 18 boundary condition is incorrect. 19 Q. Okay. If you've made that -- Let's take it 20 this way. 21 You can't sit here today and say your model 22 is correct if that assumption is incorrect that all 23 the air comes out of the head and neck. 24 MR. GOSS: Object as calling for 25 speculation.</p>	<p style="text-align: right;">Page 152</p> <p>1 hypothetical. 2 A. I know. But I'm getting on the record that 3 I -- there's no basis for the hypothetical, and I want 4 -- I want that clear. 5 But let's say that it is correct and air 6 exhausts somewhere else. The fact of the matter is, 7 the easiest pathway -- buoyant air wants to rise, hot 8 air wants to rise, and the easiest pathway would -- 9 would be for it to rise up through the location which 10 I've articulated on this diagram. So even if air came 11 out somewhere else, it's my opinion it would 12 ultimately enter the -- enter -- it would likely enter 13 the room through the place I've just annotated. 14 Q. Okay. Assuming that 50 percent of the air 15 was exhausted to below the operating room table, and 16 50 percent of the air came out of the head and neck, 17 would you agree with me that you can't confirm that 18 the model is correct? 19 MR. GOSS: Same objection. 20 A. Sitting here now -- 21 I mean the word "confirm" to a scientist has 22 a very high bar. Sitting here now, if -- I would like 23 to know more about the hypothetical. If -- If hot air 24 is vented beneath the table, it's my opinion, sitting 25 here now, it is -- would most likely rise and still</p>
<p style="text-align: right;">Page 151</p> <p>1 A. I disagree. 2 Q. Well you just said it may or may not be 3 correct. 4 A. You used the word "all." Let's say, for 5 example, 99 percent of -- 6 Let's say we find out tomorrow 99 percent of 7 the air comes out by the head and 1 percent comes out 8 somewhere else. There's no reason to think that my 9 results wouldn't be accurate. 10 Q. What if it was 50/50? 11 A. I don't -- 12 Sitting here, I don't know the answer to 13 that. 14 Q. Okay. So let's assume that half the air 15 comes out of the hair and neck and half -- half the 16 air goes down below the drape. Would you agree with 17 me that the model that you have submitted as part of 18 Exhibit 1 cannot be confirmed as correct? 19 MR. GOSS: Object to form. 20 A. I disagree. 21 Q. Okay. Why? 22 A. Well first of all I disagree with the 23 hypothetical, but let's assume your hypothetical's 24 correct. 25 Q. You don't have to agree with my</p>	<p style="text-align: right;">Page 153</p> <p>1 exit through the head and neck, so I would have no 2 reason to doubt my results. 3 Q. So your assumption is that no matter where 4 the hot air goes, at the end of the day all of it's 5 going to come out of the head and neck. 6 A. That is not my assumption, and I didn't 7 state that. 8 Q. Well you said if the hot air rises, the hot 9 air is going to rise no matter where it goes, and then 10 it's going to come out of the head and neck area. 11 Do I need to read your answer again? 12 A. No. I know the answer. 13 What you said is if 50 percent of the hot 14 air goes beneath the table and 50 percent dir -- is 15 vented directly from the head and neck, would that 16 invalidate my results. And in that case it's my 17 opinion the air would most likely still leave by the 18 head and neck. 19 But let's say 50 percent of the hot air 20 exited by the foot of the patient. Well then I would 21 change my answer because that air would not rise by 22 the head and neck, so -- so I am not -- so I think you 23 mischaracterized my testimony. 24 Q. Okay. 25 MR. GOSS: Gabe, if you get to a good spot</p>

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<p style="text-align: right;">Page 154</p> <p>1 for a lunch break, let us know. 2 MR. ASSAAD: Okay. 3 Q. Do you believe it's possible that based on 4 the geometry that air -- hot air could escape to the 5 side of the drape? 6 A. Can you define what you mean by "the side of 7 the drape"? 8 Q. Like you have a head, the feet, and then the 9 two sides. Do you think, based on your geometry, that 10 air could escape the sides, hot air, below the drape 11 to the side? 12 A. No. 13 Q. Okay. And what's your basis behind that? 14 Scientific basis. 15 A. Well let's take this case as an example. On 16 the one side the Bair Hugger was wrapped around the 17 back of the patient so that air cannot escape, and -- 18 Q. Was it wrapped around the back or was it 19 tucked in -- 20 A. Both. 21 Q. -- underneath the pad? 22 A. Both. 23 Q. Well it can't be both. It's either one 24 side's tucked under the pad, or it's wrapped 25 underneath the patient.</p>	<p style="text-align: right;">Page 156</p> <p>1 heat rises. So that stationary air now has to escape, 2 and what it wants to do is it wants to rise. There is 3 no reason to expect that that air would go down, 4 vertically downwards, go underneath the drape and then 5 come back up. 6 Here is an analogy I'd like to use. Let's 7 -- Let's pretend that this is a match. [Demonstrating 8 with the red pen.] And let's pretend this red part is 9 the flame. If I hold the match like this, hot air 10 rises. You see the flame go up, you see the soot, et 11 cetera. If I -- Even if the air was to be vented 12 downwards, which it's not, because it's vented against 13 the skin, what happens when I do this? 14 [Demonstrating.] The flame still rises, the smoke 15 still rises. 16 I cannot get a match to have a flame that 17 will go down vertically, somehow travel underneath the 18 drape and then come back up, and that's the basis. 19 Q. Do you really believe that? 20 A. I am certain of it. 21 Q. You're certain of it. 22 A. Absolutely. 23 Q. Hundred percent. 24 A. Scientists never say 100 percent. I would 25 say within a reasonable degree of engineering</p>
<p style="text-align: right;">Page 155</p> <p>1 A. Oh, no. I said wrapped around the back. 2 Q. When you say "wrapped around the back," what 3 do you mean? 4 A. It -- It was wrapped around the back of the 5 patient and then tucked in. 6 Q. Tucked in underneath the pad. 7 A. It was tucked in somewhere -- some part of 8 the bed. 9 Q. Okay. 10 A. I did not -- 11 If I said it was tucked underneath the 12 patient, then that's a mistake. 13 Q. Okay. Fair enough. 14 A. That air clearly cannot vent beneath the 15 room -- or beneath the table. I'm sorry. 16 But let's talk about the other air. This 17 Bair Hugger blanket is a blanket with tubes, air 18 tubes, and when you inflate it and you put on the 19 cotton layer -- the cotton blanket and the drapes it 20 wraps around the arm. And the way it works is you 21 have very small jets of air that shoot out of those 22 tubes and they impact the skin right away. In fact 23 there's a connection between those tubes and the skin. 24 So what happens is you have a warm, almost stagnant 25 air space. Now we know hot air rises. Colloquially,</p>	<p style="text-align: right;">Page 157</p> <p>1 certainty, yes. 2 Q. So if I put a -- 10 space heaters facing up 3 five feet from the ceiling, okay, I turn them all on, 4 are you telling me I'm not going to feel heat down 5 here? 6 A. That's not what I said. 7 Q. Okay. So heat can actually go down; 8 correct? Depending on if there's any insulation 9 above, conservation of energy; correct? It's going to 10 -- The hot air is going to start warming the air below 11 and below and it's going to keep on going down until 12 it reaches us, correct, in my -- in my hypothetical, 13 in my example. "Yes" or "no"? 14 A. I cannot answer that -- 15 Q. Okay. 16 A. -- with a "yes" or "no." 17 Q. If you can't answer "yes" or "no," that's 18 fine. We'll move on. 19 A. No. I can answer it. I can't answer it 20 with a "yes" or "no." 21 Q. Okay. Let's move on. 22 (Interruption by the videographer.) 23 MR. ASSAAD: Two minutes? One more 24 question. 25 BY MR. ASSAAD:</p>

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<p style="text-align: right;">Page 158</p> <p>1 Q. If hot air does get below the operating room 2 table, you agree with me if the heat fills up 3 underneath the operating room table, when it escapes 4 the drape on the sides it's going to start rising; 5 correct? 6 A. Your question -- 7 MR. GOSS: Object to form. 8 A. -- is based on a faulty premise. 9 Q. Forget about the premise. 10 Just say if there's -- if there's heat 11 underneath the operating room table to the point where 12 when it escapes the drape it's -- the air is warmer 13 than the ambient temperature, that air is going to 14 rise; correct? 15 MR. GOSS: Same objection. 16 A. So if you had a perfectly insulated table -- 17 I mean, to have your hypothetical work you would have 18 to have it perfectly insulated, you would have to 19 allow the heat to build up, and that's not what 20 happens. 21 Q. Okay. But if it does happen and it escapes 22 out the side the air is going to rise; correct? 23 A. If you had a perfectly insulated space under 24 the table and you didn't let any heat leave, and you 25 put heat into that space until the entire air space</p>	<p style="text-align: right;">Page 160</p> <p>1 AFTERNOON SESSION 2 (Deposition reconvened at 3 approximately 1:49 p.m.) 4 (Mr. Bushnell joined the 5 proceedings.) 6 BY MR. ASSAAD: 7 Q. You ready to continue, Dr. Abraham? 8 A. Yes. Thank you. 9 Q. You understand the allegations by the 10 plaintiffs in this case; correct? 11 A. I understand generally that there is an 12 allegation that for -- the Bair Hugger may cause 13 infections. 14 Q. Or significantly increase the risk of 15 infection. 16 A. I -- I don't know the specific allegation 17 made in this case, so I -- so no. 18 Q. But you understand that for hip and knee 19 implant surgery, infections are a serious thing. 20 A. That's my understanding. 21 Q. And they could be deadly; correct? 22 A. That is my understanding. 23 Q. And you agree with me no matter what side 24 you're on, plaintiffs' side or the defense side, if -- 25 if the Bair Hugger does cause an increase in hip and</p>
<p style="text-align: right;">Page 159</p> <p>1 was warm, then yes. 2 MR. ASSAAD: Okay. We can take a lunch 3 break. 4 THE REPORTER: Off the record, please. 5 (Luncheon recess taken at 6 approximately 12:56 p.m.) 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25</p>	<p style="text-align: right;">Page 161</p> <p>1 knee implant infections that that's not a good thing. 2 MR. GOSS: Object to form. 3 A. I would agree. 4 Q. Okay. Because, you know, people -- if that 5 is the case, people's lives are at stake. 6 MR. GOSS: Same objection. 7 A. I agree. 8 Q. Okay. And in fact you once were quoted for 9 saying: In my research, people's lives are literally 10 at stake. There is very little room for error when 11 you're designing devices that will be implemented into 12 bodies or trying to remove pathogens from dirty water 13 that a village relies upon. I need the very best 14 students who I can depend on to recognize that while 15 engineering is fun, it is also deadly serious. Lauren 16 is such a student. 17 Do you remember making that quote? 18 A. Yes. 19 Q. Okay. So although engineering is fun, it 20 can be deadly serious; correct? 21 A. Yes. 22 Q. Okay. And we want to be for sure, we want 23 to be certain, when we formulate opinions, that 24 because the effect of these opinions could be -- have 25 detrimental effects on people, we need to be serious</p>

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<p style="text-align: right;">Page 162</p> <p>1 about it; correct?</p> <p>2 MR. GOSS: Object to form.</p> <p>3 A. I agree.</p> <p>4 Q. Okay.</p> <p>5 MR. ASSAAD: Basis?</p> <p>6 MR. GOSS: Effects of opinions could be</p> <p>7 deadly?</p> <p>8 MR. ASSAAD: Yeah.</p> <p>9 Q. I mean, if your opinion in this case is, to</p> <p>10 3M, that the Bair Hugger doesn't increase the risk of</p> <p>11 surgical-site infections and it actually does, but 3M</p> <p>12 relies upon it to keep it in the market or not make</p> <p>13 any changes to the product, that could be a -- an</p> <p>14 opinion that could cause serious harm; correct?</p> <p>15 MR. GOSS: Object to form. You can answer</p> <p>16 if you understand the question.</p> <p>17 A. I'm --</p> <p>18 Yes.</p> <p>19 Q. Okay. Now -- And the --</p> <p>20 And Lauren Vallez is the person you were</p> <p>21 talking about earlier that is a -- is a co-author on</p> <p>22 the article that was submitted and accepted for</p> <p>23 publication regarding the 505 and 750; correct?</p> <p>24 A. Yes.</p> <p>25 Q. And you've published a lot with her;</p>	<p style="text-align: right;">Page 164</p> <p>1 neck. Do you recall that testimony?</p> <p>2 A. Yes.</p> <p>3 Q. Do you have any calculations that you</p> <p>4 performed to support that assumption?</p> <p>5 A. Are you asking me do I have calculations to</p> <p>6 support the idea that the air will rise?</p> <p>7 Q. No. That the air will come from the arm --</p> <p>8 the air that's being blown on the end of the hand is</p> <p>9 going to migrate up the arm and out the head and neck</p> <p>10 of the patient.</p> <p>11 A. I have no calculations.</p> <p>12 Q. Okay.</p> <p>13 A. I have my experience in buoyant flow motion.</p> <p>14 Q. Okay. But you have no calculations;</p> <p>15 correct?</p> <p>16 A. Correct.</p> <p>17 Q. Do you have any experimental testing to</p> <p>18 indicate of such?</p> <p>19 A. There is experimental testing. Well that's</p> <p>20 a complex answer, I'm going to give it a few ways.</p> <p>21 I'm going to give the answer in a few ways.</p> <p>22 I have experimental testing that shows the</p> <p>23 air does not exhaust beneath the table.</p> <p>24 Q. And what testing was that?</p> <p>25 A. That was testing --</p>
<p style="text-align: right;">Page 163</p> <p>1 correct?</p> <p>2 A. Yes.</p> <p>3 Q. Okay. And if I recall correctly, isn't she</p> <p>4 off to California?</p> <p>5 A. I believe that's true.</p> <p>6 Q. Is she still in town, or has she left for</p> <p>7 California?</p> <p>8 A. I don't know.</p> <p>9 Q. Okay. But she took a -- she's doing a Ph.D.</p> <p>10 program, is it at Stanford?</p> <p>11 A. That sounds correct.</p> <p>12 Q. Okay. Speaking about Stanford, are you --</p> <p>13 do you know, personally, Dr. Krishnan Mahesh?</p> <p>14 A. No.</p> <p>15 Q. You understand that he's a professor at the</p> <p>16 University of Minnesota; correct?</p> <p>17 A. If you present that, I have no reason to</p> <p>18 doubt that.</p> <p>19 Q. Okay. So you don't know that he came from</p> <p>20 Stanford and was part of the Ph.D. students that</p> <p>21 worked on the code that was used by Elghobashi?</p> <p>22 A. I don't know that.</p> <p>23 Q. Okay. Now we -- you mentioned before we</p> <p>24 took up the lunch break that if air is coming on the</p> <p>25 arm it's going to migrate up and come out the head and</p>	<p style="text-align: right;">Page 165</p> <p>1 That was flow visualization testing done in</p> <p>2 the OR with the draping as used in a hip or knee</p> <p>3 replacement.</p> <p>4 Q. When you say "flow visualization testing,"</p> <p>5 what device did you use?</p> <p>6 A. The device we mentioned earlier in this</p> <p>7 deposition. I believe it's called a megasonic fog</p> <p>8 device.</p> <p>9 Q. Okay.</p> <p>10 A. Okay?</p> <p>11 Q. So --</p> <p>12 A. In addition to that my findings are</p> <p>13 corroborated by testing from Tom Kuehn, and by</p> <p>14 literature that the plaintiffs rely upon.</p> <p>15 Q. Okay. But I'm talking about you yourself.</p> <p>16 Have you done any experimental testing,</p> <p>17 besides using the fog generator, to support your</p> <p>18 assumption that all the air, even the air coming --</p> <p>19 hitting the end of the hand, is going to migrate up</p> <p>20 out of the head and neck?</p> <p>21 A. No.</p> <p>22 Q. Okay. In your analysis does the temperature</p> <p>23 underneath the operating room table increase in</p> <p>24 temperature?</p> <p>25 A. Temperature does not increase temperature.</p>

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<p style="text-align: right;">Page 166</p> <p>1 Q. I'm saying does the temperature in -- I'm 2 sorry. 3 Does the air underneath the operating room 4 table increase in temperature? 5 A. I don't know -- I don't recall extracting 6 that data point. I would presume it does. I would 7 presume that the air underneath the operating table 8 may increase, but I don't believe I presented that in 9 this document, and I don't think I extracted that 10 data. 11 Q. Can -- 12 If I go to your TRN file, can I extract that 13 data? 14 A. Yes. 15 Q. Okay. If it does increase in temperature, 16 would that not indicate that hot air is blowing down? 17 A. Not necessarily. 18 Q. What would cause the increase in 19 temperature? 20 A. Before I answer that can you tell me the 21 increase in temperature of what? 22 Q. The air underneath the operating room table. 23 A. Okay. Thank you. 24 Q. Let's say two inches below the operating 25 room table.</p>	<p style="text-align: right;">Page 168</p> <p>1 A. That is correct. 2 Q. Okay. So let's go -- 3 So how long did your model run to get to 264 4 step -- time step? 5 A. Sitting here now I don't know the answer to 6 that. 7 Q. But if we go to the TRN file that's 8 something we could determine? 9 A. Yes. 10 Q. Okay. And we could do that based on the 11 time step; correct? 12 A. It would be information contained within the 13 TRN file. 14 Q. If you did change the time step between time 15 zero and time step 264, would you have increased or 16 decreased the time step? 17 A. I don't know. 18 Q. So sitting here today we will never be able 19 to know that answer; correct? 20 A. Sitting here today, I don't know if or 21 whether I increased or decreased the time step. 22 Q. And if you did increase the time step you 23 wouldn't know if you increased it or decreased it. 24 A. That is correct. 25 Q. Okay. So sitting here today we could not</p>
<p style="text-align: right;">Page 167</p> <p>1 A. Air temperature -- 2 Heat can get below the operating table a 3 number of different ways, in fact we mentioned this 4 earlier in this deposition. There are three modes of 5 heat transfer; conduction, convection and radiation. 6 So if I were to measure, let's say, the temperature 7 directly underneath the operating table, and if I were 8 to measure a temperature increase it could be by one 9 of those three mechanisms. It may be that air has 10 migrated under the table, it may be that that region 11 has been heated by conduction, or it may be that it's 12 been heated by radiation. 13 Q. Well we could agree in your model, since all 14 the solids or all the geometry's adiabatic, that area 15 cannot be created -- be heated up by conduction; 16 correct? 17 A. That is correct. 18 Q. And since it's adiabatic it can't be -- 19 there's no convective heat that's being transferred to 20 that, correct, through the table. 21 A. Convection would not refer to heat transfers 22 through the table. 23 Q. Okay. And there's no radiative heat that 24 would warm up underneath the operating room table 25 because the table is adiabatic.</p>	<p style="text-align: right;">Page 169</p> <p>1 replicate that in ANSYS. 2 A. That is incorrect. 3 Q. Well how am I supposed to know the time step 4 if you don't know the time step? 5 A. When we use the word "replicate" in CFD, 6 what we mean is can you reproduce the results. Anyone 7 with my TRN file could reproduce my results, whether 8 or not they used the same time step or a different 9 time step, provided it was sufficiently small. So the 10 TRN file is all that you need to reproduce the 11 results. 12 Q. When you say "sufficiently small," what do 13 you mean by "sufficiently small"? 14 A. It has to be small enough so that the size 15 of the time step does not affect the results. 16 Q. Okay. In the beginning of running a model 17 do you want a large time step or a small time step for 18 a model such as this? 19 A. I prefer a small time step. 20 Q. Okay. And what would you consider small? 21 A. Less than a second. 22 Q. What about less than a tenth of a second? 23 A. Likely less than a tenth of a second. 24 Q. So if I represent to you that your TRN files 25 says .01 seconds, would you disagree with that?</p>

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<p style="text-align: right;">Page 170</p> <p>1 A. I would not disagree with that.</p> <p>2 Q. Is that something that you would likely do</p> <p>3 for a time step in a situa -- in a model such as this?</p> <p>4 A. It seems reasonable.</p> <p>5 Q. Okay. Having the fact that it was .01 --</p> <p>6 Well let me ask you this: How would you</p> <p>7 know that the time step you used didn't affect the</p> <p>8 model?</p> <p>9 A. You'd run the calculation, as I said before,</p> <p>10 and obtain quasi-steady results, and once your results</p> <p>11 were quasi steady and you abide by certain rules of</p> <p>12 the numerics, such as the Courant number has to be low</p> <p>13 enough, you would assume that the results are</p> <p>14 time-step independent.</p> <p>15 Q. You used the word "Courant number"; correct?</p> <p>16 A. Correct.</p> <p>17 Q. And have you heard the term "CFL" number?</p> <p>18 Are you familiar with that?</p> <p>19 A. "CFL number"?</p> <p>20 Q. Yes.</p> <p>21 A. It doesn't --</p> <p>22 I've heard "CFL." I can't place it right</p> <p>23 now.</p> <p>24 Q. So you've never heard of the</p> <p>25 Courant-Friedrichs-Lewy number?</p>	<p style="text-align: right;">Page 172</p> <p>1 the TRN file, so I can't answer that "yes" or "no."</p> <p>2 Q. Well where would this image be taken from?</p> <p>3 A. As noted in this report, calculations were</p> <p>4 done for an 8.1 million-element mesh, and a mesh that</p> <p>5 was approximately 60 million.</p> <p>6 Q. So you did calculations for a 60 million</p> <p>7 mesh?</p> <p>8 A. That's correct.</p> <p>9 Q. And are the results in this report?</p> <p>10 A. No.</p> <p>11 Q. Why not? Did it --</p> <p>12 Did it converge?</p> <p>13 A. Yes.</p> <p>14 Q. And you've gotten results?</p> <p>15 A. Correct.</p> <p>16 Q. Why didn't you produce those results?</p> <p>17 A. Because the results were the same, and it's</p> <p>18 our practice in computational fluid dynamics to show</p> <p>19 that your results are independent of mesh and then to</p> <p>20 show one set of results.</p> <p>21 Q. So my understanding is the calculations for</p> <p>22 the six -- the 60-million-grid mesh no longer exist.</p> <p>23 A. I don't know if they exist.</p> <p>24 Q. Okay. How long did it take you to calculate</p> <p>25 the 60-million-grid mesh?</p>
<p style="text-align: right;">Page 171</p> <p>1 A. That's probably the same thing as the</p> <p>2 Courant number I was mentioning.</p> <p>3 Q. Well do you think it's the same number, or</p> <p>4 is it something similar to that number?</p> <p>5 A. I think it's the same number, --</p> <p>6 Q. Okay.</p> <p>7 A. -- but I would have to check the --</p> <p>8 Q. Okay.</p> <p>9 A. -- whatever resource to verify.</p> <p>10 Q. Now you mentioned earlier that --</p> <p>11 Well let me ask you this question: Is the</p> <p>12 mesh that you used in the TRN file the mesh you put in</p> <p>13 Figure 2 on page 4?</p> <p>14 A. I think it is.</p> <p>15 Q. Okay. Well do you know one way or the</p> <p>16 other?</p> <p>17 A. No.</p> <p>18 Q. Okay. Well how would you formulate this</p> <p>19 mesh for your report if it did not come from the TRN</p> <p>20 file?</p> <p>21 A. It is likely it is from the TRN file.</p> <p>22 Q. Okay. So you believe that your mesh in the</p> <p>23 TRN file is as fine as it's in this -- depicted in</p> <p>24 Figure 2.</p> <p>25 A. I don't recall if this image was taken from</p>	<p style="text-align: right;">Page 173</p> <p>1 A. I don't know.</p> <p>2 Q. Was it done --</p> <p>3 When was it done?</p> <p>4 A. It would have been done about the same time</p> <p>5 that the initial calculations were done. We have that</p> <p>6 list of the time stamp, which I think was November</p> <p>7 2015, so approximately then.</p> <p>8 Q. Okay. Was it done in LES or RANS?</p> <p>9 A. I believe it was LES.</p> <p>10 Q. Okay. So -- And what was the time step --</p> <p>11 step?</p> <p>12 A. I don't recall.</p> <p>13 Q. Would it have been less than a second?</p> <p>14 A. I'm pretty sure it would have been less than</p> <p>15 a second, but I don't recall.</p> <p>16 Q. Okay. So it's your testimony today that --</p> <p>17 Well how long did it take to run?</p> <p>18 A. I don't recall.</p> <p>19 Q. A month, two months, five months?</p> <p>20 A. Well not five months, but I don't recall how</p> <p>21 long it took.</p> <p>22 Q. Can you give me an approximation?</p> <p>23 A. No.</p> <p>24 Q. Less than three months?</p> <p>25 A. I don't know.</p>

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<p style="text-align: right;">Page 174</p> <p>1 Q. Okay. So it's your --</p> <p>2 Well, so less than five; correct?</p> <p>3 A. Yes.</p> <p>4 Q. Greater than a month?</p> <p>5 A. I can't say.</p> <p>6 Q. Okay. And what computer did you do it on?</p> <p>7 A. A St. Thomas computer.</p> <p>8 Q. A 16-core computer?</p> <p>9 A. Yes.</p> <p>10 Q. How long do you think it would take for a</p> <p>11 16-core computer to run an LES mesh with 60 million</p> <p>12 cells?</p> <p>13 A. Depends on how long you run it. It depends</p> <p>14 on how many time steps.</p> <p>15 Q. Well how long did --</p> <p>16 A. What we -- Hold on.</p> <p>17 Sorry. That was inappropriate for me to say</p> <p>18 "hold on." I apologize.</p> <p>19 In computational fluid mechanics what a</p> <p>20 standard practice is to run code on more than one mesh</p> <p>21 to show that the results -- the conclusions don't</p> <p>22 depend on the mesh.</p> <p>23 Q. Called mesh independence; correct?</p> <p>24 A. That's correct.</p> <p>25 Q. How'd you perform your mesh independence?</p>	<p style="text-align: right;">Page 176</p> <p>1 A. I believe there are. It would not surprise</p> <p>2 me if the entire mesh was tetrahedral.</p> <p>3 Q. Okay. So would you agree with me that the</p> <p>4 mesh that's used in Figure 2 is most likely the mesh</p> <p>5 used for your 60-million-cell mesh?</p> <p>6 A. I would say I don't recall which one it is.</p> <p>7 Q. Okay. And your mesh independence was solely</p> <p>8 based on the streamlines.</p> <p>9 A. Correct.</p> <p>10 Q. Okay.</p> <p>11 A. It was based on the trajectory of the fluid</p> <p>12 flow in the room.</p> <p>13 Q. Which create the streamlines.</p> <p>14 A. Correct.</p> <p>15 Q. Okay. Did you do path lines?</p> <p>16 A. I did not.</p> <p>17 Q. Okay. And we could agree that you did not</p> <p>18 add particles to the flow; correct?</p> <p>19 A. Correct. It was unnecessary.</p> <p>20 Q. Well I understand you believe it's</p> <p>21 unnecessary, but you don't have to -- I'm just asking</p> <p>22 you correct or not. I don't need -- If I want a</p> <p>23 reason, I'll ask you for a reason.</p> <p>24 So you agree with me you didn't add</p> <p>25 particles to the flow; correct?</p>
<p style="text-align: right;">Page 175</p> <p>1 A. Visualization of streamlines.</p> <p>2 Q. Okay. So you'd done a mesh for eight</p> <p>3 thousand one hundred or whatever it -- eight million</p> <p>4 one -- eight million one hundred thousand; correct?</p> <p>5 A. Correct.</p> <p>6 Q. And you did one for approximately 60</p> <p>7 million.</p> <p>8 A. Correct.</p> <p>9 Q. Exactly how many cells were used?</p> <p>10 A. I don't recall the exact number, sitting</p> <p>11 here.</p> <p>12 Q. Okay. And do you know what shapes were used</p> <p>13 in the approximate 60-million-cell mesh?</p> <p>14 A. Yes.</p> <p>15 Q. What?</p> <p>16 A. The same shapes that were used in the</p> <p>17 8.1-million-cell mesh.</p> <p>18 Q. So the tetrahedras.</p> <p>19 A. And pyramid.</p> <p>20 Q. Okay. Well if I show you your ANSYS program</p> <p>21 today and there's no mention of any pyramid shapes,</p> <p>22 would you disagree with that?</p> <p>23 A. No.</p> <p>24 Q. Okay. So you're not absolutely certain that</p> <p>25 there are pyramid shapes in your mesh.</p>	<p style="text-align: right;">Page 177</p> <p>1 A. I did not.</p> <p>2 Q. Did you change the geometry between the</p> <p>3 8-million-cell mesh and the 60-million-cell mesh?</p> <p>4 A. Yes.</p> <p>5 Q. How did you change the geometry?</p> <p>6 A. In the 60-million-cell mesh we actually</p> <p>7 extended the geometry into the vents, the outlet</p> <p>8 vents. And in the 8-million-cell mesh we did not.</p> <p>9 Q. So in the 8-million-cell mesh you removed</p> <p>10 the vents; correct?</p> <p>11 A. In the 8-million-cell mesh we represented</p> <p>12 the vents on the wall, and in the 60-million-cell mesh</p> <p>13 we actually extended the solution up into the exhaust</p> <p>14 vents --</p> <p>15 Q. Okay.</p> <p>16 A. -- so that would be into the wall.</p> <p>17 Q. Okay. In your meshing, what algorithm did</p> <p>18 you use?</p> <p>19 A. I think I used a tetrahedral-based</p> <p>20 algorithm, but I don't recall.</p> <p>21 Q. Was it patch conformal or patch</p> <p>22 non-conformal?</p> <p>23 A. I don't recall.</p> <p>24 Q. Is there any way to determine that today?</p> <p>25 A. Not today.</p>

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<p style="text-align: right;">Page 178</p> <p>1 Q. How? How would I determine that?</p> <p>2 A. You -- From the TRN.</p> <p>3 Q. So that would be in the TRN file?</p> <p>4 A. Correct.</p> <p>5 Q. Okay. Were any mesh controls used?</p> <p>6 A. Sizing controls were used.</p> <p>7 Q. Anything else?</p> <p>8 A. Curvature controls were probably used,</p> <p>9 sitting here now I don't know for sure; and proximity</p> <p>10 controls were probably used, sitting here now, I don't</p> <p>11 know for sure.</p> <p>12 Q. So mesh controls would have curvature and</p> <p>13 proximity values you could add to it?</p> <p>14 A. That is correct.</p> <p>15 Q. Did you use any defeaturing tools?</p> <p>16 A. I defeatured manually. When we talked</p> <p>17 earlier today about removing small features, that was</p> <p>18 a manual defeaturing.</p> <p>19 Q. Did you make --</p> <p>20 Did you change any features of the drape?</p> <p>21 A. No.</p> <p>22 Q. Did you change any features of the patient?</p> <p>23 A. No.</p> <p>24 Q. Okay. And how'd you determine the quality</p> <p>25 of your mesh?</p>	<p style="text-align: right;">Page 180</p> <p>1 to mesh independence to change the geometry?</p> <p>2 A. The geometry --</p> <p>3 If the geometry materially impacts the</p> <p>4 results, then no.</p> <p>5 Q. So why did you change the geometry?</p> <p>6 A. Because it was a defeaturing, as we</p> <p>7 mentioned. I defeatured the presence or absence of</p> <p>8 these vents. The ducts extended into the wall doesn't</p> <p>9 matter. So in my judgment there was no reason to</p> <p>10 calculate the flow up into the wall, so they were</p> <p>11 removed.</p> <p>12 Q. And that was for the 8.1 million cells.</p> <p>13 A. Correct.</p> <p>14 Q. Okay. But you thought it was necessary for</p> <p>15 the 60 million cells?</p> <p>16 A. No. It was probably not necessary for the</p> <p>17 60 million cells.</p> <p>18 Q. Which one did you run first, the 60 million</p> <p>19 or the 8.1 million?</p> <p>20 A. I don't recall.</p> <p>21 Q. What metrics did you use to check the mesh,</p> <p>22 besides grid independence?</p> <p>23 A. I may have looked at --</p> <p>24 I may have looked at shape quality, such as</p> <p>25 skewness or orthogonality, but in my experience those</p>
<p style="text-align: right;">Page 179</p> <p>1 A. I determined the quality of the mesh by the</p> <p>2 fact that the solution -- the results were independent</p> <p>3 of the mesh, and that's the ultimate arbiter of</p> <p>4 whether the mesh is a good quality.</p> <p>5 Q. Now was the only thing that was changed</p> <p>6 between -- Well, strike that.</p> <p>7 We agree that we changed -- you changed the</p> <p>8 geometry between the 8.1-million-cell mesh and the</p> <p>9 60-million-cell mesh; correct?</p> <p>10 A. Correct.</p> <p>11 Q. Okay. Was the only geometry changed the</p> <p>12 vents, exhaust vents?</p> <p>13 A. That's the only thing I can recall now.</p> <p>14 Q. Okay. Everything else was kept the same?</p> <p>15 A. To my recollection, yes.</p> <p>16 Q. Okay. Is it the same equations, used</p> <p>17 Boussinesq?</p> <p>18 A. I believe that's true, yes. Same equations.</p> <p>19 Q. Okay. So just so I understand, your</p> <p>20 determination of the mesh quality was solely based on</p> <p>21 doing the mesh-independence test between the 8.1</p> <p>22 million cells and the 60 million cells.</p> <p>23 A. That is the gold standard for determining</p> <p>24 mesh quality, and yes, that's the method I used.</p> <p>25 Q. Okay. Is the standard practice with respect</p>	<p style="text-align: right;">Page 181</p> <p>1 are not important for determining the mesh quality for</p> <p>2 a solution, so I relied upon a comparison of the</p> <p>3 results, mesh independence.</p> <p>4 Q. Okay. So sitting here today if I asked you</p> <p>5 what the aspect ratio was, or the skewness, or the</p> <p>6 expansion ratio, you wouldn't know.</p> <p>7 A. I would not know, and it's immaterial.</p> <p>8 Q. I understand you think it's immaterial.</p> <p>9 That's your opinion.</p> <p>10 So the answer to the question is you would</p> <p>11 not know sitting here today.</p> <p>12 MR. GOSS: All right. Wait for him to ask</p> <p>13 a question.</p> <p>14 Q. You don't know the answers to the skewness,</p> <p>15 aspect ratio or expansion ratio sitting here today;</p> <p>16 correct?</p> <p>17 A. Correct.</p> <p>18 Q. Okay. So do you know if your aspect</p> <p>19 ratio -- it could have been anywhere from .1 to 15,</p> <p>20 you wouldn't know.</p> <p>21 A. I don't know the aspect ratio.</p> <p>22 Q. Okay. Do you know whether or not the Bair</p> <p>23 Hugger created any areas of turbulence in the</p> <p>24 operating room when you ran it?</p> <p>25 A. Yes.</p>

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<p style="text-align: right;">Page 182</p> <p>1 Q. Where?</p> <p>2 A. Whenever you have rising buoyant flow into a</p> <p>3 larger space you almost always have turbulence.</p> <p>4 Q. I understand that.</p> <p>5 My question was where in the operating room.</p> <p>6 A. So places where we have rising heated flow</p> <p>7 in this simulation are places where you would have</p> <p>8 turbulence, and that would clearly be shown on Figure</p> <p>9 11.</p> <p>10 Q. Okay. Is Figure 11 the temperature</p> <p>11 distribution of the room?</p> <p>12 A. Yes.</p> <p>13 Q. Okay. At a -- At time step 264; correct?</p> <p>14 A. Correct.</p> <p>15 Q. Okay. Now --</p> <p>16 Going back to time step. If you ra -- If</p> <p>17 there is only 264 time steps, would that -- would I be</p> <p>18 able to calculate how long you let the model run?</p> <p>19 A. Do you mean the computer time?</p> <p>20 Q. No. Like how long it took from the initial</p> <p>21 conditions to time step 264.</p> <p>22 A. I believe you would be able to determine</p> <p>23 that from the TRN.</p> <p>24 Q. Okay. So if the TRN for 264 -- And I'm</p> <p>25 talking about simulation time. You understand when I</p>	<p style="text-align: right;">Page 184</p> <p>1 before 264 of .001 seconds?</p> <p>2 A. It is possible.</p> <p>3 Q. And if that's the case, then it would be</p> <p>4 less than 2.64 seconds for the simulation; correct?</p> <p>5 A. Correct.</p> <p>6 Q. Okay. Do you --</p> <p>7 Do you set the time step change prior to</p> <p>8 starting the model run, or can you change it in the</p> <p>9 middle of a run?</p> <p>10 A. You can change it in the middle of a run.</p> <p>11 Q. Okay. And you said the run for the -- for</p> <p>12 the 8.1 million model took 40 days.</p> <p>13 A. Yes.</p> <p>14 Q. Okay. And it took 40 days to get 264 time</p> <p>15 steps?</p> <p>16 A. Well remember I have a file at 300, --</p> <p>17 Q. Okay.</p> <p>18 A. -- so I went beyond 264. I don't recall how</p> <p>19 far I went, but it took 40 days to do the calculation.</p> <p>20 Q. I understand that. And you think -- It</p> <p>21 could be 300, it could be 264, you don't know.</p> <p>22 A. Correct.</p> <p>23 Q. Okay. And you said this report was done by</p> <p>24 Science Day; correct?</p> <p>25 MR. GOSS: Object to form.</p>
<p style="text-align: right;">Page 183</p> <p>1 say "simulation time"?</p> <p>2 A. Yes.</p> <p>3 Q. I mean, a one-second simulation could take a</p> <p>4 week on the computer.</p> <p>5 A. Correct.</p> <p>6 Q. Okay. So if the time step that you used was</p> <p>7 .01, then I would multiply that by 264 to get the</p> <p>8 actual time of simulation?</p> <p>9 A. If the time steps for those first 264</p> <p>10 calculations was the same, then correct.</p> <p>11 Q. Okay. Do you have any reason to believe</p> <p>12 that you changed the time step between time step zero</p> <p>13 and time step 264?</p> <p>14 A. Sitting here now, no.</p> <p>15 Q. Okay. So if the time step is 264, then the</p> <p>16 model would have ran for 2 -- the simulation would</p> <p>17 have ran for 2.64 seconds; correct?</p> <p>18 A. Correct.</p> <p>19 Q. And at that point you determined that, based</p> <p>20 on the instantaneous velocity measurements of the</p> <p>21 model, that you had quasi-static results.</p> <p>22 A. Correct.</p> <p>23 Q. Okay. Did you start the model at time zero?</p> <p>24 A. Yes.</p> <p>25 Q. Is it possible that you used a time step</p>	<p style="text-align: right;">Page 185</p> <p>1 Q. All the pictures and the meshes and</p> <p>2 everything.</p> <p>3 A. Boy, I think it was. I think all of these</p> <p>4 were done by Science Day.</p> <p>5 Q. You said previously today that you ran</p> <p>6 through 2500 time steps; correct?</p> <p>7 A. The 505 results include the 2540 time step</p> <p>8 result.</p> <p>9 Q. Okay. How many time steps did you run for</p> <p>10 the 750?</p> <p>11 A. I don't know.</p> <p>12 Q. Okay. But it wasn't 2500.</p> <p>13 A. Correct.</p> <p>14 Q. Okay. Then I misunderstood you.</p> <p>15 I thought we were talking about the 750.</p> <p>16 A. The 2500 pertained to the --</p> <p>17 Q. 505.</p> <p>18 A. -- 505.</p> <p>19 Q. And that's why we have a file named 2540</p> <p>20 TRN.</p> <p>21 A. Correct.</p> <p>22 Q. Okay. And you believe that there is a time</p> <p>23 step 300 that was --</p> <p>24 Well let me ask you this: Can you preset</p> <p>25 the amount of time steps you want in a model?</p>

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<p style="text-align: right;">Page 186</p> <p>1 A. Yes.</p> <p>2 Q. Did you do that in this -- in the 750 case?</p> <p>3 A. No.</p> <p>4 Q. So you just ran it till you believed you had</p> <p>5 a solution.</p> <p>6 A. Correct.</p> <p>7 Q. Till you had convergence.</p> <p>8 A. Till I had a quasi-steady solution.</p> <p>9 Q. Okay. Now you'll agree with me that if your</p> <p>10 boundary conditions are not correct, the model's not</p> <p>11 correct.</p> <p>12 A. If your boundary conditions differ in a way</p> <p>13 that's substantive --</p> <p>14 Let me put it this way: The software solves</p> <p>15 the problem for the boundary conditions. If the</p> <p>16 boundary conditions that you put into the software</p> <p>17 differ significantly from the actual boundary</p> <p>18 conditions then I agree, the solution will not reflect</p> <p>19 reality.</p> <p>20 Q. So if your boundary condition's different</p> <p>21 from the actual, real-life conditions, then the model</p> <p>22 will not be accurate.</p> <p>23 A. If the difference is significant.</p> <p>24 Q. Okay. And you criticize Elghobashi on a</p> <p>25 number of things, but one of them is his boundary</p>	<p style="text-align: right;">Page 188</p> <p>1 A. If his boundary conditions are correct and</p> <p>2 if mine are incorrect, then that would cause me</p> <p>3 concern that my results are not correct.</p> <p>4 Q. Well from an experienced computational fluid</p> <p>5 dynamics engineer, you would agree with me that the</p> <p>6 results of the TRN file that we're looking at in this</p> <p>7 case would not depict what would occur if the air was</p> <p>8 going underneath the operating room table and not out</p> <p>9 the head and neck; correct?</p> <p>10 A. We have to be very careful and exact in our</p> <p>11 words.</p> <p>12 If the air left the bottom of the drape and</p> <p>13 oozed uniformly from the drape into the room, as Dr.</p> <p>14 Elghobashi assumed, that would be a very different</p> <p>15 boundary condition than the one I used. And if he is</p> <p>16 correct, then I have great concern about my</p> <p>17 calculations.</p> <p>18 Now if the air is exhausted, let's say along</p> <p>19 the arm, maybe under the table, but then still exits</p> <p>20 by the head and neck, then I am much less concerned.</p> <p>21 Q. Okay. Well when you say "greatly</p> <p>22 concerned," it would question your reliability in your</p> <p>23 results; correct?</p> <p>24 A. Yes.</p> <p>25 Q. And you couldn't sit here today and say that</p>
<p style="text-align: right;">Page 187</p> <p>1 conditions; correct?</p> <p>2 A. That is correct.</p> <p>3 Q. And that's why you say he's incorrect;</p> <p>4 right?</p> <p>5 A. That is one of the reasons.</p> <p>6 Q. Okay. And so therefore if your boundary</p> <p>7 conditions are incorrect, then your analysis would be</p> <p>8 incorrect; correct?</p> <p>9 A. If the difference between my boundary</p> <p>10 conditions and the correct boundary conditions is</p> <p>11 significant, then yes, I agree with you.</p> <p>12 Q. For example, if none of the air comes out</p> <p>13 the head and neck but goes below the operating room</p> <p>14 table, then -- and that -- and you are incorrect in</p> <p>15 that assumption, then your model would be incorrect.</p> <p>16 True?</p> <p>17 MR. GOSS: Object to form, improper</p> <p>18 hypothetical.</p> <p>19 A. I would say this. My model has a boundary</p> <p>20 condition where the air leaves through the head and</p> <p>21 neck area into the room. I do not have a boundary</p> <p>22 condition like Elghobashi where the air leaves at the</p> <p>23 bottom of the drape and then into a room. I would</p> <p>24 call that a significant difference.</p> <p>25 Q. Okay.</p>	<p style="text-align: right;">Page 189</p> <p>1 my results are correct and reliable because of these</p> <p>2 great concerns.</p> <p>3 A. Correct.</p> <p>4 Q. Okay. How do you determine if a difference</p> <p>5 is significant?</p> <p>6 A. One way to determine it is to run both cases</p> <p>7 and to compare the results. That's probably the most</p> <p>8 direct way.</p> <p>9 Q. Okay. And it's quite clear that your</p> <p>10 results are much different than Elghobashi's results;</p> <p>11 correct?</p> <p>12 A. Correct.</p> <p>13 Q. But with respect to your analysis, you did</p> <p>14 not -- you did not analyze particle flow; correct?</p> <p>15 A. It was unnecessary.</p> <p>16 Q. That wasn't my answer -- my question.</p> <p>17 You did not analyze particle flow; correct?</p> <p>18 A. Correct.</p> <p>19 Q. Okay. Now you formulated your assumptions</p> <p>20 back in 2015; correct?</p> <p>21 A. Yes.</p> <p>22 Q. That was before any of the depositions in</p> <p>23 this MDL; correct?</p> <p>24 A. Correct.</p> <p>25 Q. Before any of these expert witnesses were</p>

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<p style="text-align: right;">Page 190</p> <p>1 identified in written reports. 2 A. Correct. 3 Q. Okay. Before any -- 4 Let me ask you this. Did anyone at 3M 5 indicate to you that all the air comes from the head 6 and neck? 7 A. No. 8 Q. Okay. Did you see any 3M testing that 9 stated the opposite? 10 A. No. 11 Q. If they had actual testing done that 12 indicated that -- that not all the air comes out of 13 the head and neck, but most of it goes down -- from 14 the arm section down below, would that change your 15 opinions in this case? 16 A. I would need to see the -- 17 MR. GOSS: Object to form. 18 A. -- details of the tests. 19 Q. Okay. 20 A. It's possible. 21 Q. You would agree with me that if you only ran 22 your model for 2.5 seconds, roughly, that although you 23 may be able to get changes -- determine quasi-static 24 solution for a velocity, you could not apply that to a 25 change in temperature in the operating room. True?</p>	<p style="text-align: right;">Page 192</p> <p>1 A. Well I'm under oath and I'm obligated to 2 tell the truth, and so I'm presenting to you that 3 these results were very similar to the initial 4 conditions. 5 Q. So you believe the initial conditions in an 6 operating room would show very little temperature 7 gradient between the ceiling and the floor? 8 "Yes" or "no," or you don't know. 9 MR. GOSS: Take your time and give the 10 answer to the best of your ability. 11 A. Can you re-ask the question? 12 Q. Based on Figure 11 the temperature gradient 13 between the ceiling and the floor is constant. Do you 14 believe that your initial conditions -- 15 Do you believe that the temperature gradient 16 in an operating room would be constant from the 17 ceiling, where the air is coming out of, to the floor? 18 A. Figure 11 does not show that. 19 Q. You're saying it's a different color from 20 the ceiling and the floor? 21 A. Yes. 22 Q. How much of a difference? 23 A. Let me explain. 24 Q. I'm asking you a question. How much of a 25 difference? You can look at the picture.</p>
<p style="text-align: right;">Page 191</p> <p>1 A. I disagree. 2 Q. You disagree. Why? 3 A. Remember you have to have initial conditions 4 to start, and if your initial conditions are very good 5 you can be very close to a quasi-steady result from 6 time zero, and that's the whole point of setting good 7 initial conditions. 8 Q. But you don't know what your initial 9 conditions are. 10 A. I -- Well I had reasonable initial -- I had 11 very good initial conditions. 12 Q. But sitting here today you do not know what 13 your initial conditions are; correct? 14 A. My initial conditions were almost identical 15 to the flow patterns that we see here, here 16 [indicating]. 17 Q. Are you guessing? 18 A. No. 19 Q. So how do I -- how do I -- 20 How do you prove that to me, by just stating 21 off the top of your head that your initial conditions 22 are here, equivalent to here, here, here, here and 23 here [indicating]? 24 MR. GOSS: Objection, move to strike, 25 mischaracterizes his testimony.</p>	<p style="text-align: right;">Page 193</p> <p>1 If you know. If you don't know, that's 2 fine. 3 A. You have in your possession, I believe, an 4 image which shows the temperature gradient vertically 5 in the room for the 505. This image -- 6 Q. 750, you mean. 7 A. For the 505. 8 Do you have any of the 505 results? 9 Q. I'm not talking about the 505, I'm talking 10 about the 750 here. 11 A. I -- I know you are. 12 Q. I did not look at the 505 results because 13 they don't apply to this report. 14 A. Okay. But had you looked at them, they 15 showed the temperature variation vertically in a room 16 and they -- the image that I used there was more 17 appropriate to detect the temperature difference be -- 18 than this image, because this image is called what's 19 -- what's called scaled globally. That means the 20 hottest value in the entire room is red, the coldest 21 value in the entire room is dark blue. I scaled it 22 this way so that you could see the hot -- hot spots, 23 any hot spots in the room. 24 If I wanted to show the image that you've 25 articulated -- by the way, which I have created -- I</p>

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<p style="text-align: right;">Page 194</p> <p>1 would have scaled it differently. I would have scaled 2 it, for example, from 59 to maybe 70, and then the 70 3 degree areas would be red. 4 So this image does not show that there is no 5 temperature variation in a room. It is scaled to show 6 the min and max range. 7 Q. Okay. 8 A. Okay? 9 Q. What other images -- 10 Do you have images that you've scaled it to 11 a different range? 12 A. Yes. 13 Q. Have you provided that to counsel? 14 A. Yes. 15 Q. And that has not been provided to me. 16 So what other images have you created that 17 you provided to counsel that's not in your report? 18 A. Image -- 19 MR. GOSS: I would just state for the 20 record I'm not sure that it hasn't been provided. 21 But you can answer the question, if you 22 can. 23 A. I don't know what images have been provided 24 by counsel, but I've done calculations with the 505. 25 Q. I'm not talking about the 505, I'm talking</p>	<p style="text-align: right;">Page 196</p> <p>1 A. Correct. 2 Q. Okay. So the temperature gradient in the 3 room is 105.9 to 59 -- 59 to 105.9; correct? 4 A. No, it is not. 5 Q. Why not? 6 A. Because the term "gradient" means a change 7 of something over a distance. Gradient is like 8 velocity. 9 What you're talking about is a temperature 10 difference, not a gradient. 11 Q. Okay. Lack of term. 12 Temperature difference is between 59 degrees 13 and 105.9 degrees. 14 A. Correct. 15 Q. Okay. And since -- 16 You have the choice of using ideal gas in 17 ANSYS, or Boussinesq; correct? 18 A. That is correct. 19 Q. And you chose Boussinesq because it's 20 quicker computation; correct? 21 A. Incorrect. 22 Q. It's not? 23 Why did you use Boussinesq? 24 A. It is quicker, but I chose it because it 25 makes it a worst-case scenario. It stacks the cards</p>
<p style="text-align: right;">Page 195</p> <p>1 about the 750. I don't care about the 505, that's not 2 part of your report. Do you understand that, sir? 3 A. Yes. 4 Q. Okay. So with the 750 are there other 5 images that show temperature gradients? 6 A. Not that I'm aware of. 7 Q. Okay. Did you use a sub-grid model for your 8 -- for the LES? 9 A. Yes. 10 Q. What was the sub-grid model? 11 A. The wall-adapted large-eddy model. 12 Q. So W-A-L-E? 13 A. Yes. 14 Q. And any -- 15 And that was constant throughout your whole 16 model; you didn't make any changes to that? 17 A. Correct. 18 Q. Okay. And you used Boussinesq? 19 A. Yes. 20 Q. Okay. And you agree with me that the 21 temperature gradient on Figure 11 is from 105.9 22 degrees to 59 degrees; correct? 23 A. I disagree. 24 Q. You have air coming out of the Bair Hugger 25 at 105.9 degrees; correct?</p>	<p style="text-align: right;">Page 197</p> <p>1 against 3M and so it's a worst-case scenario. 2 Q. How does it stack the cards against -- 3 I mean, isn't the whole point of doing CFD 4 is to be as accurate as possible and to show exactly 5 what happens in a model that would happen in real 6 life? 7 A. Not necessarily. 8 Q. So is that not what you did here? Is this 9 -- Is what you did in your -- in your modeling what 10 happens in real life? 11 A. Let me explain. 12 Q. "Yes" or "no," then you could explain. 13 A. Yes. 14 Q. Okay. 15 A. When we do a calculation we have to make 16 choices, and we can make choices that are judgements, 17 and sometimes those judgements may affect the results 18 in small ways. What I like to do is do what's called 19 a bounding calculation. I like to assume worst-case 20 scenarios. If I assume a worst-case scenario against 21 the manufacturers of the Bair Hugger, and if I -- if 22 my results show that the air does not intrude to the 23 surgical site then I have added confidence that under 24 a more exact calculation the results would hold. 25 Q. Worst-case scenario you performed?</p>

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<p style="text-align: right;">Page 198</p> <p>1 A. The Boussinesq --</p> <p>2 Q. No. I'm saying you -- in all the</p> <p>3 assumptions you made you determined the worst-case</p> <p>4 scenario.</p> <p>5 A. For the buoyancy model I did.</p> <p>6 Q. Okay. You didn't --</p> <p>7 You didn't assume it for where the air goes;</p> <p>8 correct? The hot air.</p> <p>9 A. Well that --</p> <p>10 (Interruption by the reporter.)</p> <p>11 A. When we make assumptions, we make</p> <p>12 assumptions on things that we're uncertain about.</p> <p>13 Things that -- Let me give you an example. The air</p> <p>14 coming out of the blanket. It could be 41 Celsius, it</p> <p>15 might be 33 Celsius. We don't know for sure. And in</p> <p>16 fact you might have some air that's 33 and some air</p> <p>17 that's 41, so there's a judgment that has to be made.</p> <p>18 In those cases I tend to prefer judgements that stack</p> <p>19 the cards against the case so that if my results come</p> <p>20 out to show no intrusion, I have more confidence.</p> <p>21 Q. By the way, in your report you said the war</p> <p>22 -- on page 6 [5]: "The warm air from the Bair Hugger</p> <p>23 blanket was treated as a second inlet to the room near</p> <p>24 the patient's head and the temperature of the air</p> <p>25 leaving the blower and entering the blanket was set to</p>	<p style="text-align: right;">Page 200</p> <p>1 generally it's a few degrees colder than body core</p> <p>2 temperature. So in metric units maybe 34 degrees</p> <p>3 Celsius.</p> <p>4 Q. What about the core?</p> <p>5 A. The core is approximately 37.</p> <p>6 Q. Okay. Skin temperature, around the chest.</p> <p>7 A. No.</p> <p>8 Q. What about the skin around the -- like the</p> <p>9 chest and everything?</p> <p>10 A. It depends on the clothing that peoples wear</p> <p>11 -- people are wearing. I would estimate, sitting</p> <p>12 here, with a reasonable degree of certainty, between</p> <p>13 35 and 36.</p> <p>14 Q. Okay. So I'm a little bit confused, because</p> <p>15 heat transfer goes from something that's hot to</p> <p>16 something that's cold; correct?</p> <p>17 A. That is correct.</p> <p>18 Q. Okay. And I think that's --</p> <p>19 Is that the second law of thermodynamics?</p> <p>20 A. No.</p> <p>21 Q. Okay. Maybe I'm wrong.</p> <p>22 So are you aware of internal studies of 3M</p> <p>23 that actually measured the temperature underneath the</p> <p>24 blanket when it's being used?</p> <p>25 A. No.</p>
<p style="text-align: right;">Page 199</p> <p>1 the highest value of 43 degrees Celsius. This assumes</p> <p>2 a worst-case scenario; the temperature of the air</p> <p>3 exiting near the patient's head should be</p> <p>4 significantly less than 43 degrees Celsius -- the</p> <p>5 value used in these -- "the value used in these</p> <p>6 calculations was 43 degrees Celsius."</p> <p>7 Correct?</p> <p>8 A. You have read that correctly.</p> <p>9 Q. Is that what you used, you used 43 or 41?</p> <p>10 A. It's a typo. It should have been 41.</p> <p>11 Q. Okay. Because 41 degrees is 106, not 43.</p> <p>12 A. That's -- That's right.</p> <p>13 Q. Okay. So that's a typo.</p> <p>14 Any other typos I should be aware of?</p> <p>15 A. Not that I know of.</p> <p>16 Q. Okay. And now do you know what the</p> <p>17 temperature of a human body is? I'm sure you do</p> <p>18 because you've done studies on it.</p> <p>19 A. Yes, I do.</p> <p>20 Q. What's the skin temperature of a human body?</p> <p>21 A. It depends on the environment that they're</p> <p>22 in. If you're out here in Minnesota in the winter</p> <p>23 your skin temperature is going to be colder than in</p> <p>24 the summer. It also depends on the part of the body,</p> <p>25 the face and nose and ears tend to be colder, but</p>	<p style="text-align: right;">Page 201</p> <p>1 Q. Why'd you come up with 41 degrees then?</p> <p>2 A. I've studied these blankets for years. I've</p> <p>3 studied 3M's blankets and other blankets. Through my</p> <p>4 study know that when the air -- let's say the air</p> <p>5 enters the blankets at 43 Celsius, it transfers heat</p> <p>6 to the body and loses heat. It loses -- lowers its</p> <p>7 temperature. As the air exit -- exits out the holes</p> <p>8 it will be somewhat less than 43. Now in some parts</p> <p>9 of the -- The blanket's not a uniform temperature. If</p> <p>10 we were to lay a blanket out on this table and let's</p> <p>11 say the hose entered here and the end of the blanket</p> <p>12 was here, you would actually show a temperature</p> <p>13 decrease as you went from one end to the other.</p> <p>14 Q. Did you ask for 3M whether or not they have</p> <p>15 measured the uniformity of their temperature under the</p> <p>16 blankets?</p> <p>17 A. I did not.</p> <p>18 Q. Wouldn't that be something that would be</p> <p>19 good to know?</p> <p>20 A. Not necessary for my calculations.</p> <p>21 Q. Okay. Well --</p> <p>22 A. So what I did --</p> <p>23 Q. You're making the assumption, sir, that the</p> <p>24 air might be different at one part of the blanket or</p> <p>25 the other. Is that based on any experiments done on</p>

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<p style="text-align: right;">Page 202</p> <p>1 the Bair Hugger, or just an educated guess?</p> <p>2 A. It's based on experiments done on the Bair</p> <p>3 Hugger.</p> <p>4 Q. What studies?</p> <p>5 A. I cannot tell you.</p> <p>6 Q. Well I'm sitting here today and I need to</p> <p>7 know, so I can go back and check your credibility,</p> <p>8 what studies you're referring to.</p> <p>9 Is it listed in -- in any -- in your CV?</p> <p>10 A. No.</p> <p>11 Q. Okay. Is it studies you've done for 3M or</p> <p>12 Arizant?</p> <p>13 A. No.</p> <p>14 Q. So what studies are they?</p> <p>15 A. Actually, let me take that back.</p> <p>16 We did do studies in the 2000, 2002 period</p> <p>17 where we measured temperature of air inside the Bair</p> <p>18 Hugger, and there is clearly a temperature variation</p> <p>19 as you move along the blanket.</p> <p>20 So I made an engineering decision. I</p> <p>21 decided to use the hottest reasonable temperature at</p> <p>22 the exhaust because that would promote buoyant mixing.</p> <p>23 (Abraham Exhibit 8 marked for</p> <p>24 identification.)</p> <p>25 BY MR. ASSAAD:</p>	<p style="text-align: right;">Page 204</p> <p>1 Q. And I'm going to tell you and I'm going to</p> <p>2 represent to you that what they do at 3 -- at Arizant</p> <p>3 at this time is they have a -- a bed with many</p> <p>4 thermocouples on it and they place the Bair Hugger and</p> <p>5 they check how much of the -- how much heat is coming</p> <p>6 out of the -- out of the holes onto the test bed.</p> <p>7 Have you ever heard of them doing that?</p> <p>8 MR. GOSS: The Bair Hugger blanket.</p> <p>9 MR. ASSAAD: Bair Hugger blanket.</p> <p>10 Q. Have you --</p> <p>11 Have you seen that test before?</p> <p>12 A. No.</p> <p>13 Q. Okay. Do you have any reason to believe</p> <p>14 that 3M or Arizant would incorrectly provide data in</p> <p>15 this case to the plaintiffs?</p> <p>16 MR. GOSS: Object to the lack of</p> <p>17 foundation.</p> <p>18 A. Could you repeat the question?</p> <p>19 Q. Withdraw that question, it was a bad</p> <p>20 question.</p> <p>21 Do you see here, under "Model 750 warming</p> <p>22 unit" that under "New (M9) 522," and I represent</p> <p>23 that's a new change in the Bair Hugger blanket, that</p> <p>24 the average temperature across the blanket is 41.1</p> <p>25 degrees?</p>
<p style="text-align: right;">Page 203</p> <p>1 Q. Was assuming 41 degrees in 3M's favor --</p> <p>2 Was assuming 41 degrees in favor of 3M, or</p> <p>3 -- or an assumption made in favor of 3M, worst-case</p> <p>4 scenario?</p> <p>5 A. You've handed me a document --</p> <p>6 Q. That's a different question. I'm asking you</p> <p>7 a different question. I haven't got to this document</p> <p>8 yet.</p> <p>9 A. Okay.</p> <p>10 Q. Your assumption that 41 degrees is coming</p> <p>11 out of the blanket, was that in 3M's favor of creating</p> <p>12 a worst-case scenario?</p> <p>13 A. It was a worst-case scenario against 3M.</p> <p>14 Q. "Against 3M." Okay. All right.</p> <p>15 What's been marked as Exhibit Number 8 is a</p> <p>16 document produced during the litigation which is a</p> <p>17 data of measurements taken by the Bair Hugger 505, as</p> <p>18 well as the 750, used with different blankets -- with</p> <p>19 a upper body blanket, a new body blanket and an older</p> <p>20 body 522 blanket.</p> <p>21 Have you seen this document before?</p> <p>22 A. I do not recall seeing this document.</p> <p>23 Q. Okay. Do you see where it talks about MCST,</p> <p>24 the average of temperature across the blanket?</p> <p>25 A. Yes.</p>	<p style="text-align: right;">Page 205</p> <p>1 A. I see it says that, and I don't know what it</p> <p>2 -- what me -- what the meaning of "average temperature</p> <p>3 across the blanket" is.</p> <p>4 Q. Okay. Do you see where it says the standard</p> <p>5 deviation is .7?</p> <p>6 A. I see that.</p> <p>7 Q. Okay. So sitting here today you've never</p> <p>8 seen this document.</p> <p>9 A. I don't recall ever seeing this document.</p> <p>10 Q. Okay. Wouldn't it be --</p> <p>11 I mean, why recreate the wheel? Wouldn't it</p> <p>12 be just proper to ask 3M, hey, do you have any data on</p> <p>13 what the temperature is coming out of the blanket?</p> <p>14 A. Not necessary. I've got a lot of experience</p> <p>15 with these devices, so I trust my own judgment.</p> <p>16 Q. Do you have experience with the Bair Hugger</p> <p>17 blower 750 and the Model 522 blanket?</p> <p>18 A. I don't know.</p> <p>19 Q. Okay. Do you have any experience with the</p> <p>20 750 prior to this study?</p> <p>21 A. I don't --</p> <p>22 I would have to look to see what models I've</p> <p>23 studied.</p> <p>24 Q. Okay. So if you can't remember what you</p> <p>25 even studied, how do you have experience on what the</p>

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<p style="text-align: right;">Page 206</p> <p>1 heat output and the airflow and the -- and what the 2 temperature is coming out of the blanket if you can't 3 even remember if you've even seen the device before? 4 A. Because I've studied many of these blankets 5 and they all have a very similar behavior. The flow 6 enters into the blanket through a tube, typically the 7 temperature at entry is 43 or 44 Celsius, there is a 8 temperature drop as you move from one end to the other 9 of the blanket. Regardless of which blanket you're 10 studying, regardless of the manufacturer, regardless 11 of the brand, there are those temperature variations. 12 Q. But you don't know in this case. 13 A. What's that? 14 Q. You don't know in the 522 what the 15 temperature difference is; do you? 16 A. Which temperature difference are you talking 17 about? 18 Q. Across the blanket. 19 A. But where across the blanket? 20 Q. From -- From the hose where it's coming in 21 at 43 degrees, and what's coming out of the 22 perforations at the opposite end. You don't know what 23 the change in -- the Delta T is; do you? 24 A. No, but I can estimate it within a 25 reasonable degree of certainty.</p>	<p style="text-align: right;">Page 208</p> <p>1 blanket, on average, is 41.1 degrees Celsius? 2 MR. GOSS: Objection, lack of foundation. 3 This document does not contain any of those 4 experimental details. 5 Q. Assuming that's what -- that's what they 6 did, would you agree with me that the temperature 7 coming out is 41.1 degrees; "yes" or "no"? "Yes" or 8 "no"? 9 A. You take -- 10 Q. If you don't agree, you don't agree. 11 A. It's not that I agree or disagree, but I 12 would, for example, want to know the room temperature, 13 and I would want to know the constitution of the table 14 upon which they sit this. If they put it on a table 15 that's an insulator you're going to get a higher 16 temperature. If it's in a room -- If it's covered by 17 draping and blankets you'll get a higher temperature. 18 There are many factors that go into these 19 temperatures, and from this document I cannot assess 20 them. 21 Q. Okay. But you agree that the 41 degrees 22 that you used is consistent with the 41 degrees that 23 is coming out of the blanket according to this 24 document, Exhibit Number 8; correct? 25 A. I am not in agreement that -- If --</p>
<p style="text-align: right;">Page 207</p> <p>1 Q. What would you estimate it as, how many 2 degrees difference? 3 A. A couple degrees. 4 Q. Okay. So 43 to about 41 degrees Celsius; 5 correct? 6 A. Correct. 7 Q. So the average temperature coming out of the 8 Bair Hugger at about 41.1 seems reasonable. 9 A. It's not clear to me that this is the 10 average temperature coming out of the Bair Hugger. 11 What this says is "across the blanket." Now I would 12 need to more -- know more information; for example, 13 did they measure inside the channels of the -- of the 14 Bair Hugger, or are they measuring outside or are they 15 measuring the wall? 16 Q. I just told you. I told you. 17 I said they have a thermal bed -- a 18 thermocouple -- a table with many thermocouples, they 19 placed the Bair Hugger on top, turn it on, of course 20 the Bair Hugger's going to rise a little bit because 21 of the -- because that's what it does, and the 22 convective currents are hitting the thermocouples and 23 this is the measurement. If that -- 24 Assuming that is the way they tested it, 25 would you agree with me that the air coming out of the</p>	<p style="text-align: right;">Page 209</p> <p>1 If this MCST is the temperature coming out 2 of the blanket, if it is, then yes, the value I used 3 is consistent with it. 4 Q. Okay. Which would be inconsistent with what 5 Dr. Settles measured less than one millimeter coming 6 out of the hole; correct? 7 MR. GOSS: Object to form. 8 A. I don't believe they are inconsistent. 9 Q. Okay. Are you aware that Dr. Settles 10 criticized your boundary conditions? 11 A. Yes. 12 Q. Okay. So you believe that you could get a 13 measurement less than one millimeter out of a heated 14 air jet that dropped the temperature from 41 degrees 15 to 32 to 33 degrees? 16 A. That's not necessarily the case. In my 17 experience with these blankets every blanket that I've 18 seen has a temperature variation across the blanket. 19 It would go from maybe 43 down to 37 or 35. 20 Q. You just testified a Delta of two degrees 21 from one end to the other. 22 A. I don't know if I did, and if I did, that 23 was not -- 24 Q. So it's incorrect testimony back then? 25 A. Well I'd have to see the question. It may</p>

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<p style="text-align: right;">Page 210</p> <p>1 be. You may be misrepresenting the question that you 2 asked. 3 Q. Oh no. I said to you: The hose here, 43 4 degrees, what would be the temperature drop at the 5 other end of the Bair Hugger blanket, and you said 6 about two degrees. 7 Do you remember me putting my arms like 8 this? 9 A. Yeah. I would not agree with that. 10 Q. Okay. 11 A. What I would say is -- and I remember the 12 context of this where you posed a hypothetical to me, 13 or you -- you presented to me an experiment, and the 14 experiment that you presented was, assume that the 15 average air temperature coming out of the blanket's 16 41; is that consistent with your work? And I agreed 17 to that. 18 Q. Okay. 19 A. But that is not the same as saying it's a 20 Delta T of two degrees across the blanket. 21 Q. And your mass flow rate coming out of the 22 Bair Hugger device is .025 kilograms per second; 23 correct? Page 5. 24 A. No. I used .023. 25 Q. Okay. For a partially obstructed blanket</p>	<p style="text-align: right;">Page 212</p> <p>1 and not in the expert report of Exhibit 1? 2 A. It's a different audience, it would be read 3 by scientists who would want the equations. 4 Q. Do you not think that Dr. Elghobashi would 5 want to know the equations that you used for your 6 model? 7 A. Dr. Elghobashi, when he sees that I used the 8 LES model, would know what the equations are. 9 Q. Well wouldn't people that are reviewing 10 numerical heat transfer know what the equations are in 11 the use of the LES model? 12 A. They would. 13 Q. So why would you put the equations down if 14 they already know the equations, like Dr. Elghobashi? 15 A. Overthoroughness. 16 Q. Okay. So you were thorough in your 17 manuscript, but you were not thorough with respect to 18 identifying the equations you used in your expert 19 report. 20 MR. GOSS: Object to form. 21 A. I identified the equations in the expert 22 report by indicating the model that was used. 23 Q. Okay. Do you know what -- 24 You said LES; correct? 25 A. Correct.</p>
<p style="text-align: right;">Page 211</p> <p>1 because the blanket was tucked underneath the table; 2 correct? 3 A. Correct. 4 Q. Okay. Where'd you obtain these numbers? 5 A. These are numbers that are consistent with 6 my experience working on blankets like this measuring 7 airflow, and they were confirmed by a tech document 8 from 3M. 9 Q. Okay. Is it the tech document that has not 10 been produced by you in this case, but it was produced 11 in another production? If you know. 12 A. I produced the tech document. 13 Q. Okay. 14 A. I did not create it. 15 Q. Who created it? 16 A. I don't know the answer. 17 Q. Okay. 18 MR. ASSAAD: Let's take a break. 19 THE REPORTER: Off the record, please. 20 (Recess taken from 3:01 to 3:11 p.m.) 21 BY MR. ASSAAD: 22 Q. In your manuscript that you submitted for 23 publication you put equations down; correct? 24 A. Correct. 25 Q. Why'd you put equations down in that report</p>	<p style="text-align: right;">Page 213</p> <p>1 Q. Okay. And are you sitting here -- 2 Are you sitting here today and telling me 3 that you know the equations that were used by ANSYS 4 when you clicked -- when you used the LES model in 5 ANSYS? 6 A. There are thousands of equations. I know 7 the key equations. 8 Q. But you don't know the code; do you? 9 A. I mean, I -- I know how to do compu -- 10 Q. You do not know the ANSYS code -- 11 MR. GOSS: Well, hold on. 12 Q. -- sitting here today; correct? 13 MR. GOSS: Let him finish -- Let him finish 14 his answer, then you can ask another question. 15 A. CFX is based on something called 16 control-volume analysis for fluid mechanics. I've 17 taken a number of courses at the graduate and 18 undergraduate level on that topic. I could write the 19 equations if I had to. Fortunately, they're contained 20 within the software. 21 Q. Okay. But for the manuscript you decided to 22 put the equations, but you did not decide to put them 23 in your expert report; correct? 24 A. For the manuscript I put a brief summary of 25 the equations, and I did not put them in the expert</p>

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<p style="text-align: right;">Page 214</p> <p>1 report.</p> <p>2 Q. Did you put the Navier-Stokes equations?</p> <p>3 A. Yes.</p> <p>4 Q. Did you put the Boussinesq equations?</p> <p>5 A. No.</p> <p>6 Q. Okay. So you would agree with me that --</p> <p>7 I mean, you saw Dr. Elgho's report before</p> <p>8 you submitted your final report in this case; correct?</p> <p>9 A. That is correct.</p> <p>10 Q. And you had the opportunity, if you so</p> <p>11 choose, to add the equations; correct?</p> <p>12 A. That is correct.</p> <p>13 Q. And in fact the only thing you pretty much</p> <p>14 had to do was copy and paste from your manuscript,</p> <p>15 because your manuscript's already submitted by that</p> <p>16 point in time; correct?</p> <p>17 A. Yes.</p> <p>18 Q. But you decided not to do that; correct?</p> <p>19 A. Correct.</p> <p>20 Q. Okay. And you assumed that the lawyers, or</p> <p>21 our consultants, or even Judge Ericksen is a different</p> <p>22 audience than the peer reviewers for the -- for the</p> <p>23 journal; correct?</p> <p>24 A. Yes.</p> <p>25 Q. Okay. You do understand that Judge Ericksen</p>	<p style="text-align: right;">Page 216</p> <p>1 Select Comfort versus Tempur Sealy, Eighth</p> <p>2 District Court, Minnesota.</p> <p>3 Q. Okay. Is it --</p> <p>4 Was it state court?</p> <p>5 A. Well it's U.S. Eighth District Court.</p> <p>6 Q. What page were you looking at?</p> <p>7 A. Page 4.</p> <p>8 Q. Of your CV, of Exhibit 2?</p> <p>9 A. Yes.</p> <p>10 Q. And was your entire expert opinion excluded?</p> <p>11 A. No.</p> <p>12 Q. What part of it was?</p> <p>13 A. A very small fraction.</p> <p>14 Q. Okay.</p> <p>15 A. One opinion.</p> <p>16 Q. Was there an opinion issued by the court as</p> <p>17 to why it was excluded?</p> <p>18 A. Yes.</p> <p>19 Q. Okay. What was the reasoning; do you</p> <p>20 recall?</p> <p>21 A. No.</p> <p>22 Q. Okay. And this was back in 2014?</p> <p>23 A. The decision came out perhaps a month ago.</p> <p>24 Q. Okay. And you said United States Eighth</p> <p>25 District Court?</p>
<p style="text-align: right;">Page 215</p> <p>1 is the judge in this case.</p> <p>2 A. No. You're telling me that now.</p> <p>3 Q. Well the -- the female judge that you were</p> <p>4 in front of on Science Day was Judge Ericksen.</p> <p>5 A. Okay.</p> <p>6 Q. You understand that; correct?</p> <p>7 And she is the judge of this MDL. You</p> <p>8 understand that.</p> <p>9 A. Yes.</p> <p>10 Q. And she decides whether or not expert</p> <p>11 opinions will eventually come in or not come in during</p> <p>12 trial. Do you understand that?</p> <p>13 A. That is my understanding.</p> <p>14 Q. Okay. Have you ever had your expert</p> <p>15 opinions limited in any way?</p> <p>16 A. Yes.</p> <p>17 Q. When?</p> <p>18 A. Very recently in an intellectual property</p> <p>19 case.</p> <p>20 Q. In what court?</p> <p>21 A. I don't know.</p> <p>22 Q. What state?</p> <p>23 A. May I go to my --</p> <p>24 Q. Sure.</p> <p>25 A. -- CV? (Witness reviewing exhibit.)</p>	<p style="text-align: right;">Page 217</p> <p>1 A. I'm an engineer, so perhaps I got the court</p> <p>2 wrong.</p> <p>3 Q. Okay.</p> <p>4 A. But that's the best of my --</p> <p>5 Q. Was the case originally in Minnesota, like</p> <p>6 -- or was it in a different state?</p> <p>7 MR. GOSS: I think he gave you a file</p> <p>8 number.</p> <p>9 MR. ASSAAD: Page 4?</p> <p>10 MR. GOSS: I think it's -- the file number</p> <p>11 is listed right below where it says "United States</p> <p>12 8th District Court, Minnesota."</p> <p>13 MR. ASSAAD: Okay.</p> <p>14 Q. Was that also in front of Judge Ericksen?</p> <p>15 A. Well the -- I don't know who it's in front</p> <p>16 of.</p> <p>17 MR. GOSS: That's Janie S. Mayeron.</p> <p>18 MR. ASSAAD: Huh?</p> <p>19 MS. ZIMMERMAN: That's a Magistrate. Janie</p> <p>20 S. Mayeron.</p> <p>21 MR. GOSS: "JSM" is Janie S. Mayeron.</p> <p>22 MR. ASSAAD: Okay.</p> <p>23 BY MR. ASSAAD:</p> <p>24 Q. So Judge Ericksen limited your expert</p> <p>25 opinion?</p>

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<p style="text-align: right;">Page 218</p> <p>1 MR. GOSS: Objection, lack of foundation. 2 A. What I know is -- I don't know which judge 3 or which court limited it. The extent of my knowledge 4 is indicated by this court file number. I don't know 5 who it was. 6 Q. Okay. Now 3M's a pretty big company; 7 correct? 8 A. I believe that's true. 9 Q. Worth more than a billion dollars? 10 A. I believe that's true. 11 Q. So if they wanted to they could have spent 12 more money and created a very detailed model, CFD 13 model if they wanted to, and paid you for it; correct? 14 MR. GOSS: Object to form. 15 A. Yes. 16 Q. Okay. I mean, for example, there was 17 nothing preventing you from adding surgeons and staff 18 in your model; correct? 19 A. Correct. 20 Q. Except time and money; correct? 21 A. Incorrect. 22 Q. Okay. So you could have added people; 23 correct? 24 A. Correct. 25 Q. You could have given properties to the</p>	<p style="text-align: right;">Page 220</p> <p>1 A. I read multiple papers of his, so I'm 2 certain I read... 3 He's done more than one. 4 Q. Okay. Did you read the one that dealt with 5 the Bair Hugger 505 and its effect on the laminar 6 system and where skin squames that were represented as 7 spheres would go? 8 A. I believe I did read that. 9 Q. Okay. And do you recall reading that he 10 indicated that the Bair Hugger 505 slightly disrupted 11 the laminar flow? 12 A. I do not recall reading that. 13 Q. Would you agree with that if he said that? 14 A. It depends on what you mean by "disrupt." I 15 know that Memarzadeh's work has shown that for -- that 16 warming devices create a thermal plume, and in fact I 17 think the body heat of the patient create a thermal 18 plume that protects the surgical site, so I recall 19 that. 20 Anyone who's done an analysis has to admit 21 that everything in the room affects the flow. So no 22 one can say it has no effect. 23 Q. So everything in the room affects the flow. 24 Is that what you're saying? 25 A. Yes.</p>
<p style="text-align: right;">Page 219</p> <p>1 materials; correct? 2 A. That is correct. 3 Q. Okay. You could have had a -- 4 You could have done particle testing, or 5 added particles; correct? 6 A. Correct. 7 Q. You could have put skin squames like Dr. 8 Elghobashi and Farhad Memarzadeh did in their studies? 9 A. They did not put skin squames in, -- 10 Q. They -- 11 A. -- but I could have done particle tracking. 12 Q. You're right, they did not put skin squames. 13 They calculated the aerodynamic diameter of the skin 14 squames and placed those in their studies; correct? 15 A. Incorrect. 16 Q. They didn't calculate the aerodynamic 17 diameter? 18 A. They related skin squa -- skin squames to 19 spheres whose diameter gave the same settling 20 velocity. That's not the same as aerodynamics. 21 Q. Okay. But they both did the same thing. 22 A. I know that's what Said Elghobashi did. I 23 don't recall, sitting here, what Memarzadeh did. 24 Q. Did you read Farhad Memarzadeh's report on 25 the use of a Bair Hugger in a operating room?</p>	<p style="text-align: right;">Page 221</p> <p>1 Q. So people affect the flow; correct? 2 A. That is correct. 3 Q. Okay. Actually a -- a Bair Hugger device 4 that's sitting on the floor that sucks up air is going 5 to affect the flow; correct? 6 A. That is correct. 7 Q. Okay. And in fact you did not even put the 8 Bair Hugger device in your model; correct? 9 A. That is correct. 10 Q. Okay. The fact that heat might be causing 11 thermal plumes through, you know, the Bair Hugger 12 heating the blankets through conduction which create a 13 thermal plume is going to affect the flow; correct? 14 A. Correct. 15 Q. Okay. But none of those things you decide 16 to put into your model because you thought they would 17 be insignificant; correct? With what you're trying to 18 determine. 19 A. Correct. 20 Q. And that was your judgment call; correct? 21 A. Yes. 22 Q. And other people in the scientific community 23 may disagree with you on that; correct? 24 A. Yes. 25 Q. Sitting here today I cannot determine, or</p>

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<p style="text-align: right;">Page 222</p> <p>1 anyone on my team, or my consultants, whether or not 2 the equations that you used are the appropriate 3 equations for the model because you did not inform me 4 what the equations are; correct? 5 MR. GOSS: Well objection, lack of 6 foundation as to what you would know or be able to 7 do. 8 A. You know that I used the LES method. The 9 equations -- If you need to see the equations written 10 down they would be contained within the ANSYS theory 11 manual. So yes, sitting here today you could. 12 Q. Okay. You agree with that ANSYS is not 13 verified for every single type of physics; correct? 14 A. I don't understand your question. 15 Q. Well "verified" applies to the mathematics 16 and "validation" applies to the physics. Do you 17 understand that? 18 Have you ever heard that before? 19 A. I've heard it in a different -- slightly 20 different phrasing, but essentially yes. 21 Q. Okay. Let me ask you this. Well, strike 22 that. 23 Did you -- I might have asked this. Did you 24 put the initial conditions in your manuscript? 25 A. No.</p>	<p style="text-align: right;">Page 224</p> <p>1 use to determine the relative compu -- 2 (Interruption by the reporter.) 3 Q. -- Reynolds cubed to determine the relative 4 computational time it takes -- or how much 5 computational time is needed to solve an LES problem. 6 Do you agree? 7 A. I don't know that. 8 Q. Okay. Do you agree that the most difficult 9 calculations in computational fluid dynamics is the 10 area where there's a transition between laminar and 11 turbulent? 12 A. I would agree that that is a very difficult 13 calculation in computational fluid dynamics. 14 Q. Do you know whether or not ANSYS is able to 15 calculate those transition -- those -- those 16 transition areas? 17 A. Yes. 18 Q. It can? 19 A. Yes. 20 Q. Okay. The Boussinesq approximation, what is 21 its -- what is its underlying assumption? 22 A. The underlying assumption behind the 23 Boussinesq approximation is that you relate density 24 changes, which are the cause of buoyancy, to 25 temperature changes.</p>
<p style="text-align: right;">Page 223</p> <p>1 Q. Okay. For either the 505 or the 750? 2 A. Correct. 3 Q. Is that common practice with respect to 4 people in the CFD community when submitting a 5 peer-review paper on a model not to put the input 6 conditions? 7 A. When you say "manuscript," are you talking 8 about the manuscript that's my expert report? 9 Q. No. Your expert report's your expert 10 report. Your manuscript is what's been submitted for 11 publication. 12 A. Thank you for clarifying. 13 In the manuscript for publication I show -- 14 I show quasi-steady results have been achieved by 15 comparing two results at different times, and that is 16 sufficient, in my mind, for a peer-reviewed 17 publication. 18 Q. Okay. Would you consider the Reynolds 19 number -- 20 Let me ask you this. Is the Reynolds number 21 related to computational time in LES? 22 A. Yes. 23 Q. Okay. So the higher the Reynolds number is, 24 the longer the computational time may be; correct? 25 It's Reynolds cubed is the -- the -- CFD that you guys</p>	<p style="text-align: right;">Page 225</p> <p>1 Q. So you would agree with me that in the 2 Boussinesq approximation it disregards density for 3 every variable except for gravity; correct? 4 A. Incorrect. 5 Q. So what's your definition again? 6 A. The Boussinesq model represents density 7 variations through variations in temperature. 8 Q. You sure about that? 9 A. Yes. 10 Q. So what variables does density affect in the 11 Boussinesq model? 12 A. Your question is not well posed. 13 Let me say this. When people use the 14 Boussinesq model they're relating density variation in 15 a fluid in the buoyancy term, to temperature 16 variation. 17 Q. Do you agree that the Boussinesq 18 approximation, which came out in 1903, suggested that 19 density changes in the fluid can be neglected except 20 where mu is multiplied by G, which is gravity, or 21 density is multiplied by G, which is gravity. 22 A. Can you say that again? 23 Q. Do you agree that Boussinesq came out in 24 1903. Are you -- Are you familiar with that? 25 A. I don't know the year it came out.</p>

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<p style="text-align: right;">Page 226</p> <p>1 Q. Okay. Suggested that density changes in the 2 fluid can be neglected except where density is re -- 3 is multiplied by gravity. So it only applies to the 4 gravity term. 5 A. That's what I said in my answer. 6 Q. Okay. So you agree with me that density is 7 a constant except for with relation to gravity. 8 A. In the model that I used density was treated 9 as a constant with the exception of the term for 10 buoyancy, the density variations in buoyancy. 11 Q. Okay. 12 A. I would agree with that. 13 Q. And you agree with me that the most common 14 areas that Boussinesq has been used is in natural 15 convection equations. 16 A. I don't know if that's a fact, but that 17 would not surprise me. I believe that's true. 18 Q. And when you have a high Delta T temperature 19 difference, that the Boussinesq approximation may 20 fail. 21 A. That is correct. 22 Q. What would you consider a high temperature 23 difference? 24 A. That's a very good question. 25 In 2003 I did a study on the applicability</p>	<p style="text-align: right;">Page 228</p> <p>1 streamlines, and that tends to bring particles out of 2 the flow. 3 So for those two reasons I decided to use 4 the worst-case scenario, which is air. I tracked air 5 particles which have no gravity term and no inertia 6 term. So in that respect it's a worst-case 7 calculation. 8 Q. Well, I disagree with you mathematically and 9 as a worst-case scenario, and I'm going to tell you 10 why. 11 You don't think turbulence causes the spread 12 of particles? 13 A. I think turbulence does cause the spread of 14 particles. 15 Q. And don't you think that temperature 16 differences affect the turbulence intensity? 17 A. And in fact I included that in my analysis. 18 Q. So you agree with me they do; correct? 19 A. I agree that temperature affects turbulence. 20 Q. Okay. And the fact that particles don't 21 follow streamlines is that they may -- they may act 22 with -- they may follow velocity vectors caused by 23 turbulence; correct? 24 A. I'm not struggling because I can't answer 25 it, I'm struggling to interpret your question and to</p>
<p style="text-align: right;">Page 227</p> <p>1 of the Boussinesq model and we compared it to the 2 ideal gas model, and we used a situation where the 3 temperature difference was 150 degrees Celsius. We 4 found that in that case the Boussinesq model did an 5 excellent job of calculating the flow in an enclosure 6 in a room. 7 Q. Airflow or particle flow? 8 A. Airflow. 9 Q. What about with respect to particle flow? 10 A. In my simulations I used airflow as a 11 surrogate for particles because it's a worst-case 12 scenario. I did not -- As I stated already, I did not 13 model particles. 14 Q. So you assumed that airflow was the 15 worst-case scenario as compared to particle flow? 16 A. Yes. 17 Q. And your basis behind that assumption? 18 A. Simple. Particles have a mass that is 19 higher than their surrounding air, so particles like 20 to settle out of the air. And in fact Said Elghobashi 21 found his equivalent diameter by using the settling 22 diameter. Particles like to fall out of the flow. 23 Furthermore, particles have inertia. Multiple experts 24 have already testified to this fact. Particles have 25 inertia, and they find it hard to follow curved</p>	<p style="text-align: right;">Page 229</p> <p>1 figure out a way to artfully answer. 2 Turbulence affects particles, and in fact 3 particles can affect turbulence. Particles have 4 inertia, and when a particle gets caught in an eddy it 5 likes -- it has a tendency to leave that eddy. 6 So if you look at the simulations that I 7 have where the flow goes down, curves against the 8 ground and then curves against the wall, particles 9 would have a tendency to leave the flow at that 10 instant and land on the ground and the wall and 11 surfaces, and in fact that's why we dust. We dust, if 12 we're cleaning our house, because particles collect on 13 a table. But there's not air particles collecting on 14 this table, there's particles in -- in the air. 15 By giving -- I essentially gave my particles 16 a zero mass so they had no weight, and zero inertia so 17 that they would perfectly follow the flow. And 18 whether that flow was turbulent or not they follow the 19 flow. That's why it's a worst-case scenario. 20 Q. Well I think you just misspoke, sir, because 21 you didn't use particles in your analysis; correct? 22 A. I did not misspeak. 23 Q. Well you did, because you said I gave my 24 particles no inertia and no mass, but you did not use 25 particles in your CFD; isn't that correct?</p>

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<p style="text-align: right;">Page 230</p> <p>1 A. Actually the particles I used were air 2 particles. I tracked air. So we can talk about 3 particles, essentially I used oxygen and nitrogen 4 molecules. I followed the air, not a solid, 5 inertia-filled particle through the air. 6 Q. So you do not insert particles that have a 7 mass into your system; correct? 8 A. That is correct. 9 Q. Okay. And you agree that the reason why 10 there are particle models is because people in the 11 scientific community understand that particles do -- 12 always don't react or follow airstreams; correct? 13 A. That's correct. 14 Q. Okay. 15 A. In fact I've done particle modeling in the 16 peer review -- 17 Q. I know what you've done. I'm -- Just answer 18 my questions, please. 19 A. Okay. 20 Q. So the fact that -- 21 I mean, turbulence has a significant effect 22 on particle flow; don't you agree? 23 MR. GOSS: That's asked and answered, but 24 if you have more to say, please go ahead. 25 A. They may, and they may not.</p>	<p style="text-align: right;">Page 232</p> <p>1 was underneath the operating room table could you tell 2 me what that is in your model? 3 A. I could, and I don't have that information 4 here with me. 5 Q. Okay. How would you do it? What would you 6 look at? 7 A. I would either calc -- I would either have 8 the software extract the turbulence intensity, or I 9 would look at a surrogate like the eddy viscosity. 10 Q. Can ANSYS CFX determine turbulence 11 intensity? Is there actually a function to do that? 12 A. I believe there is, and if not you can do it 13 through other -- other parameters that it calculates. 14 Q. The eddy viscosity. 15 A. Yes. 16 Q. Okay. 17 A. In fact all you need is the fluctuating 18 component of the velocities and the average 19 velocities. 20 Q. Okay. In your manuscript did you indicate, 21 with respect to the 750, why -- or what data that you 22 used to show that it was a quasi-steady solution? 23 A. In my manuscript I compared two sets of 24 results that differed substantially in time step and 25 showed that they were immaterially different.</p>
<p style="text-align: right;">Page 231</p> <p>1 Q. But you don't know until you model it; 2 correct? 3 A. That is not true. 4 Q. Okay. Are there any turbulent areas in the 5 operating room that would be significant with respect 6 to whether or not particles could actually cause harm 7 to a patient? 8 A. Could you restate that question? 9 Q. That's a bad question. 10 Are there -- Are there any areas that there 11 exist significant turbulence in the operating room 12 model that would have an effect on particles that 13 would indicate to you that the particles would not 14 follow streamlines? 15 A. That's still a confusing question, but I'm 16 going to give an answer. I modeled turbulence. I 17 modeled particles that had the characteristics of air. 18 Insofar as there's turbulent motion in the air, those 19 carry the air. So whether we're talking about a 20 particle or not, turbulence -- whether we're talking 21 about a solid particle or whether we're talking about 22 air, the motion is affected by the turbulence and I 23 included that in my model. 24 Q. What was the turbulent intensity -- 25 If I ask you what the turbulent intensity</p>	<p style="text-align: right;">Page 233</p> <p>1 Q. For the 750 or the 505? 2 A. 750. 3 Q. Okay. And that would be the 264 and the 300 4 something? 5 A. No. I think they were further apart than 6 that. 7 Q. All right. Did you provide those data files 8 to counsel? 9 A. I don't know if I did. The data files for 10 the journal paper? I don't recall. 11 Q. And you didn't cite your reasoning or your 12 data to support that you reviewed the results to get a 13 quasi-steady solution with respect to the expert 14 report; correct? 15 A. Could you ask that again? 16 Q. In your expert report you did not provide 17 that information of the data points that you looked at 18 for you -- for your determination that the solution 19 that you provided was a quasi-steady solution. 20 A. No, that's not quite true. On page 9 I 21 actually say that images from Figures 3 through 8 22 could be replicated at other instan -- time instances 23 and the same conclusions would be drawn. 24 Q. I understand that. 25 But it's a judgment call by you whether or</p>

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<p style="text-align: right;">Page 234</p> <p>1 not you had a quasi-steady solution; correct?</p> <p>2 A. Correct.</p> <p>3 Q. And I might look at it, or my expert might</p> <p>4 look at it and disagree with you; correct?</p> <p>5 A. That's -- That's possible.</p> <p>6 Q. Okay. And they can't do that because you</p> <p>7 did not provide that data in your expert report;</p> <p>8 correct?</p> <p>9 MR. GOSS: Object to form, --</p> <p>10 A. They --</p> <p>11 MR. GOSS: -- calls for speculation.</p> <p>12 Q. The only way I could determine whether or</p> <p>13 not you have a quasi-steady solution is to look at two</p> <p>14 -- at least two TRN files; correct?</p> <p>15 A. Correct.</p> <p>16 Q. I only have one TRN file. You understand</p> <p>17 that; correct?</p> <p>18 A. Yes.</p> <p>19 Q. And you did not -- you only plotted</p> <p>20 solutions for one TRN file in your -- in your expert</p> <p>21 report; correct?</p> <p>22 A. That is correct.</p> <p>23 Q. Okay. So sitting here today I don't have --</p> <p>24 no one in the world has any information to make their</p> <p>25 own judgment call whether or not the two solutions are</p>	<p style="text-align: right;">Page 236</p> <p>1 solve?</p> <p>2 A. Single desktop.</p> <p>3 Q. Why didn't you use the Minnesota</p> <p>4 supercomputer?</p> <p>5 A. I have enough computer power with me, and</p> <p>6 there was no reason to use the Minnesota</p> <p>7 supercomputer.</p> <p>8 Q. Well you could have --</p> <p>9 I mean that supercomputer has I think 16,000</p> <p>10 cores. Does that sound about right?</p> <p>11 A. I don't know how many cores it has, but</p> <p>12 there is an inconvenience of queuing your jobs, and</p> <p>13 I'm not -- and I wasn't willing to be subject to that</p> <p>14 inconvenience.</p> <p>15 Q. So you'd rather wait 40 days?</p> <p>16 A. Yeah.</p> <p>17 Q. Do you know who Lagrange is?</p> <p>18 A. Yes.</p> <p>19 Q. Do you know who Euler is?</p> <p>20 A. Yes.</p> <p>21 Q. Their equations were not used in your CFD</p> <p>22 analysis; correct?</p> <p>23 A. Incorrect.</p> <p>24 Q. In what way were they used?</p> <p>25 A. Well the Euler method, E-U-L-E-R, is</p>
<p style="text-align: right;">Page 235</p> <p>1 close enough to make the judgment -- judgment that</p> <p>2 it's a quasi-steady solution; correct?</p> <p>3 A. From the data --</p> <p>4 From the single TRN file that I provided,</p> <p>5 correct.</p> <p>6 Q. Okay. And nothing in the report.</p> <p>7 A. Well I stated it in the report.</p> <p>8 Q. That's your opinion.</p> <p>9 But I'm saying for someone to ascertain and</p> <p>10 make a determination of whether or not your judgment</p> <p>11 is correct, no one could do that right now based on</p> <p>12 the expert report; correct?</p> <p>13 MR. GOSS: Argumentative, asked and</p> <p>14 answered.</p> <p>15 A. Correct.</p> <p>16 Q. Okay. Just out of curiosity, when you ran</p> <p>17 the model with 8.1 million cells that you said took</p> <p>18 roughly 40 days, was that the only program that was</p> <p>19 running on that machine?</p> <p>20 A. I don't know.</p> <p>21 Q. Okay. Does anyone else have access to that</p> <p>22 machine that you used?</p> <p>23 A. Yes.</p> <p>24 Q. Okay. Is it a single desktop computer or</p> <p>25 does it use, like, a combination of computers to</p>	<p style="text-align: right;">Page 237</p> <p>1 generally re -- Let me back up.</p> <p>2 In an overview, Lagrange means you follow</p> <p>3 the fluid or particle. The Euler method means that</p> <p>4 you calculate the flow by sitting in a single place in</p> <p>5 time and watching things go by you. So one has a</p> <p>6 moving perspective reference frame and the other one</p> <p>7 doesn't.</p> <p>8 The CFD used to calculate the airflow is</p> <p>9 Eulerian, E-U-L-E-R-I-A-N. Now it turns out that</p> <p>10 these two ideas can be applied to particle tracking;</p> <p>11 Lagrange particle tracking and Euler particle</p> <p>12 tracking. And with respect to particle tracking I did</p> <p>13 not -- not use either of them.</p> <p>14 Q. Do you agree that current -- that ANSYS CFX</p> <p>15 has limited capabilities for Lagrangian simulation?</p> <p>16 A. I don't know that to be true.</p> <p>17 Q. So you don't know one way or the other;</p> <p>18 correct?</p> <p>19 A. Well, I mean, every software has limited</p> <p>20 capabilities, so I don't know the context of what</p> <p>21 you're --</p> <p>22 Q. And you don't know the code that's used</p> <p>23 behind the black box of ANSYS; correct?</p> <p>24 A. That's incorrect.</p> <p>25 Q. Do you know the code?</p>

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<p style="text-align: right;">Page 238</p> <p>1 A. I could actually write the code. 2 Q. Okay. But do you know the code? 3 A. What do you mean by "know the code"? 4 Q. Do you know the software or the code behind 5 ANSYS? 6 A. I would say this. 7 MR. GOSS: Asked and answered. Go ahead. 8 A. I would say this. I know the equations that 9 go in. I know the equations that ANSYS relies upon. 10 Q. I understand that. But everyone knows the 11 equations. Everyone knows Navier-Stokes; correct? 12 MR. GOSS: I don't. 13 A. Incorrect. 14 Q. Well people that are doing CFD, like 15 professors such as yourself should know the 16 Navier-Stokes equations; correct? 17 A. That is correct. 18 Q. Okay. And the people that are writing the 19 programs should know the Navier-Stokes equation; 20 correct? 21 A. Correct. 22 Q. But some codes are verified because the 23 mathematics work out, and other codes that use -- that 24 try to solve for the Navier-Stokes equation are not 25 verified. Do you agree with that?</p>	<p style="text-align: right;">Page 240</p> <p>1 Q. Okay. 2 A. -- with that statement. 3 Q. So the mere fact that you know the equations 4 that ANSYS used, you don't know the code or the 5 algorithm they used to solve the equation. 6 A. Incorrect. 7 Q. You do? 8 A. Well you have to be careful here because 9 there's many equations and many algorithms. It's not 10 as though there's a single algorithm for ANSYS. 11 For example, there is an algorithm on how to 12 solve the mass equation over each element. There's an 13 algorithm on how to solve the momentum equation. 14 There's an algorithm on how to evaluate the density 15 variation in a -- in a natural convection flow. 16 So there are many, many algorithms. It's 17 not as though there's a single algorithm for a code. 18 Q. Have you actually looked behind the software 19 and -- and the actual code that the programmers use 20 for ANSYS CFX? 21 A. In fact -- 22 Q. It's a simple yes-or-no answer. 23 Have you looked at it? That's all I need to 24 know. 25 MR. GOSS: You can go ahead and answer.</p>
<p style="text-align: right;">Page 239</p> <p>1 A. I disagree. 2 Q. Okay. 3 A. I would have to understand more about the 4 hypothetical that you're -- 5 Q. Well -- 6 A. -- suggesting. 7 Q. -- I could write a code that solves for the 8 Navier-Stokes equations and I get wrong mathematical 9 results and therefore my code is not verified even 10 though I could write down the Navier-Stokes equations; 11 correct? 12 A. I agree. 13 Q. Okay. So a code needs to be verified; 14 correct? 15 A. I agree. 16 Q. Okay. So the code is more than just the 17 equation, it's actually the code is what they use -- 18 do to solve the equation; correct? 19 A. In this context "code" usually refers to the 20 numerical algorithm that's used to solve the 21 Navier-Stokes equations. 22 Q. So the mere fact that I know the equation 23 doesn't mean I have the correct algorithm to solve the 24 equation accurately; correct? 25 A. I agree --</p>	<p style="text-align: right;">Page 241</p> <p>1 A. In fact I've modified the code that they 2 use. 3 Q. So you looked at it. 4 A. I have looked at the code. 5 Q. Okay. That's all I need to know. 6 How would you define "natural convection"? 7 A. Natural convection is the process -- 8 Well colloquially hot air rises or heat 9 rises, but more exactly it's the process of fluid, 10 when it warms up -- and when I say "fluid" I mean a 11 gas or a liquid -- when it warms up it wants to 12 expand, and when it expands it's less dense so it 13 wants to rise. Think of a hot air balloon would be 14 natural convection. 15 Q. Do you agree with me that the density 16 between 41 degrees Celsius and the density of 59 17 degrees Celsius of air is different? 18 A. I would agree. 19 Q. Okay. And you agree with me that the 20 Boussinesq approximation does not take that difference 21 in density except for the gravity term; correct? 22 A. Incorrect. The Bou -- The dens -- The 23 buoyancy term is also in the turbulence production, 24 but it does not -- the density variation does not 25 appear in the other terms of the Navier-Stokes</p>

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<p style="text-align: right;">Page 242</p> <p>1 equations. I think that's what you're trying to get 2 at. 3 Q. So you think it's part of the turbulence 4 equations? 5 A. The Boussinesq model, my recollection is 6 that it includes density variations -- I'd have to go 7 back and look. 8 The Boussinesq model relates density 9 variations in the buoyancy term to temperature 10 variations, period. 11 Q. Do you recall what your -- Does ANSYS CFX -- 12 Strike that. 13 Does ANSYS CFX require you to give a 14 temperature for -- a reference temperature for 15 Boussinesq? 16 A. Yes. 17 Q. So what did you use? 18 A. 25 Celsius. 19 Q. "25 Celsius"? 20 Why'd you use 25 Celsius? 21 A. It's a good midpoint between 15 and 43. 22 Q. So 25 Celsius, what's that in Fahrenheit? 23 MR. GOSS: I'm going to guess 74 degrees. 24 [Calculating.] 25 Q. 77 degrees.</p>	<p style="text-align: right;">Page 244</p> <p>1 earlier, warmer air is less dense than cooler air. So 2 the air coming out of the Bair Hugger blanket, which I 3 used as 41, is less dense than air coming out of the 4 ceiling. By using a reference temperature that is 5 between the two what I did is I made a worst-case 6 scenario in that the density of air coming out of the 7 Bair Hugger was higher than it actually is in real 8 life and the density of the air coming out of the 9 ceiling is lower. And what that means is I gave the 10 Bair Hugger air more momentum. 11 So, for example, let's think of this as a 12 car and a train having a collision. The momentum 13 coming out of the ceiling is 60 times that of the Bair 14 Hugger, so it's like a train hitting a car, train 15 hitting a sedan, let's say. By using the Boussinesq 16 model I made my sedan a little heavier, I made it an 17 SUV, just to make it a worst-case scenario. 18 Q. So say you lowered the buoyancy reference 19 temperature to 50, how would that affect your model? 20 MR. GOSS: 50 Fahrenheit? 21 MR. ASSAAD: 50 Fahrenheit. 22 A. It would make the density of the air in the 23 room higher. 24 Q. Okay. You could have used ideal gas instead 25 of Boussinesq; correct?</p>
<p style="text-align: right;">Page 243</p> <p>1 So that's what you used is 77? 2 A. That's what I recall. 3 Q. Okay. You know, why'd you use seven -- 4 As a midpoint, you said? 5 A. Well it's not the exact midpoint, but it's 6 between the two. 7 Q. And why would you use -- why would you want 8 to use the midpoint? 9 A. I've done work on -- peer-reviewed published 10 work on the Boussinesq model, and what we showed is 11 that when -- even for temperature variations in a room 12 of 150 Celsius, that if you use a temperature at or 13 near the midpoint you'll get very accurate results. 14 Q. Would it -- 15 Just so I understand, is -- is the 16 temperature used in the Boussinesq, would that be 17 equivalent to the buoyancy reference temperature? 18 A. It is my -- 19 I believe it is, -- 20 Q. Okay. 21 A. -- but I'd have to check the manual. 22 Q. Okay. And how would that affect the 23 calculations? 24 A. It affects the calculations in a couple 25 ways. First of all, it mean -- as you pointed out</p>	<p style="text-align: right;">Page 245</p> <p>1 A. That is correct. 2 Q. Okay. And just so I'm absolutely sure, you 3 ran one run as RANS on the 750 and one run as LES; 4 correct? 5 A. No. 6 Q. On the 750. 7 A. All the results here, all the unsteady 8 results were LES. 9 Q. I understand that, but you ran one run of 10 RANS to get your initial conditions, and then you ran 11 one run of LES. 12 A. I believe that's true. I don't recall 13 exactly, but I'm pretty confident that is correct. 14 Q. Do you agree with me that the ideal gas is 15 more accurate than the Boussinesq? 16 A. It is more accurate, but it's not a 17 worst-case calculation, which is why I chose 18 Boussinesq. 19 Q. But it's more accurate; correct? 20 A. Correct. 21 Q. Do you agree that Dr. Elghobashi is an 22 expert in particle flow in turbulent air? 23 A. I would agree he's an expert on spherical 24 particles in perhaps high-speed flows for sure. I 25 don't know if I'd generally agree he's an expert in</p>

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<p style="text-align: right;">Page 246</p> <p>1 particle flow in air. 2 Q. Would you -- Would you -- 3 Would you consider yourself a particle 4 expert in high-speed flows? 5 A. No. 6 Q. Would you consider yourself an expert in low 7 -- with particles in low-speed flows? 8 A. Probably not. 9 Q. Okay. Have you ever done any work for the 10 Department of Defense? 11 A. Via a subcontractor, yes. 12 Q. What about directly with the Department of 13 Defense? 14 A. No. 15 Q. Have you done any work with the -- with any 16 part of the military? 17 A. No. 18 Q. Do you have access to the military 19 supercomputer? 20 A. No. 21 Q. Do you have access to a computer that could 22 do DNS modeling? 23 A. Yes. 24 Q. What computer? 25 A. The ANSYS model, the ANSYS software has the</p>	<p style="text-align: right;">Page 248</p> <p>1 experimental measurements. 2 A. I would disagree with that. 3 Q. You'd disagree with that? 4 A. Yes. 5 Q. Okay. 6 MR. ASSAAD: Let's take a break. 7 THE REPORTER: Off the record, please. 8 (Recess taken from 4:00 to 4:13 p.m.) 9 BY MR. ASSAAD: 10 Q. Are you aware of any peer-reviewed 11 literature that has modeled an operating room? 12 A. Yes. 13 Q. Is that the Farhad Memarzadeh literature? 14 A. That is one. There may be others that I 15 can't think of, but that's one of them. 16 Q. And you agree with me that Farhad Memarzadeh 17 used the RANS model; correct? 18 A. Yes. 19 Q. Okay. He didn't use LES; correct? 20 A. Correct. 21 Q. And are you aware of any peer-review 22 literature that gave -- that included no solids in 23 their CFD model? 24 MR. GOSS: Of an operating room, or more 25 generally?</p>
<p style="text-align: right;">Page 247</p> <p>1 capability of doing D -- DNS if you set a term in the 2 LES model to zero. I wouldn't use DNS for this case. 3 Q. No one could use DNS for this case. 4 A. I don't know -- 5 MR. GOSS: Wait for a question. 6 Q. Do you agree with that? 7 Can anyone do DNS for this case? 8 A. I would have to calculate how many elements 9 would be needed to recor -- to do the calculation, but 10 sitting here now I think it's unlikely someone would 11 do DNS for this. 12 Q. Do you know -- 13 Have you ever done DNS? 14 A. No. 15 Q. Do you know what type of computing is 16 required to run DNS? 17 A. What do you mean by "computing"? 18 Q. What size computer, how many cores? 19 A. It depends on the size of the problem and 20 the number of elements. 21 Q. You agree that DNS is the most accurate form 22 -- method of computational fluid dynamics. 23 A. It is generally considered the most 24 accurate. 25 Q. And in fact it's probably more accurate than</p>	<p style="text-align: right;">Page 249</p> <p>1 Q. In the operating room. 2 A. Sitting here now, no. 3 Q. Well you had no solids; correct? 4 A. That is correct. 5 Q. Okay. Now you agree with me that I could 6 try to run a model and get the same results as you can 7 without having your initial conditions; correct? 8 A. Yes. 9 Q. Your opinion is that you don't believe that 10 I need the initial conditions to obtain reproducible 11 results in this model; correct? 12 A. Correct. 13 Q. Okay. However, you would agree with me that 14 for me to verify that you had used the proper initial 15 conditions I would need to know what the initial 16 conditions are; correct? 17 A. I would disagree that there is such a thing 18 as "proper initial conditions." 19 Q. For me to verify your initial conditions I 20 would need to know the initial conditions; correct? 21 A. I would a -- I would agree for you to know 22 my initial conditions you would have to know the 23 initial conditions. 24 Q. Okay. And for me to determine whether or 25 not there is quasi-steady solution with respect to</p>

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<p style="text-align: right;">Page 250</p> <p>1 your CFD model, I would have to know the initial 2 conditions. 3 A. I don't know if that's true. 4 Q. Well do you know that it's not true? 5 A. Well let's say you ran your own code and 6 let's say you obtained initial -- quasi-steady results 7 and compared them with mine. If yours were the same 8 then you had reached quasi-steady results. 9 Q. What if mine were different? 10 A. Then you may not have quasi-steady results. 11 Q. Or you might not have quasi-steady results; 12 correct? 13 A. That could be. 14 Q. And for me to determine that I would need 15 the initial conditions to determine whether I had 16 quasi -- you had quasi-steady results or I had 17 quasi-steady results, and if we both came to different 18 results then we might have to look further at the 19 problem; correct? 20 A. I would agree. If we came to different 21 results we'd have to look further. 22 Q. Okay. So there is a possibility, without 23 the initial conditions, that I may never be able to 24 determine whether or not your results show a 25 quasi-steady solution if I cannot come to a</p>	<p style="text-align: right;">Page 252</p> <p>1 initial conditions prevents my independent 2 verification of your CFD. You agree? 3 A. I disa -- 4 MR. GOSS: Object to form. 5 A. I disagree. 6 Q. I can't verify your CFD to determine whether 7 or not you have quasi-steady solution based on your 8 one TRN value. 9 MR. GOSS: Asked and answered. 10 A. I disagree. 11 Q. You disagree to that now? 12 A. Yes. 13 Q. Okay. You told me before I need at least 14 two TRNs to determine whether or not a solution is -- 15 is a quasi-steady solution. 16 A. You need two -- 17 Let's take a step back and make sure it's 18 totally clear, and I want to make sure that I'm not 19 confused. 20 If you want to know whether your results are 21 quasi-steady you can do it a number of different ways. 22 You can compare the results to an experiment that's 23 quasi-steady, you could compare two sets of TRN files, 24 which is what you mentioned, or you could compare 25 someone else's calculations that are quasi-steady. So</p>
<p style="text-align: right;">Page 251</p> <p>1 quasi-steady solution in my results; correct? 2 MR. GOSS: Calls for speculation. 3 A. That's a complex -- 4 Could you re -- rephrase it, re-ask it? 5 Q. Well just assume that I -- I run your model 6 and I cannot come to a quasi-steady solution, okay? I 7 could determine whether or not you came to a 8 quasi-steady solution if I had your initial -- your 9 initial conditions and your final result; correct? 10 A. It's a -- 11 That was a very cumbersome question. Could 12 you just -- 13 Q. Let's make it: I cannot independently 14 verify that you have -- your solution is a 15 quasi-steady solution without another TRN file or even 16 -- or the initial conditions; correct? 17 A. You could not verify that my results were 18 quasi-steady without another TRN file. 19 Q. And, I mean, these are transient results, 20 TRN files; correct? 21 A. Correct. 22 Q. And all transient results are dependent on 23 the initial conditions. 24 A. That is correct. 25 Q. Okay. So your failure to provide the</p>	<p style="text-align: right;">Page 253</p> <p>1 there's different ways of doing it. But -- But I 2 would agree with you to know if this set of results 3 right here is quasi-steady [indicating Exhibit 1] you 4 would want to compare two different TRN files. 5 Q. Okay. Because you didn't compare your 6 results to anyone else's results; correct? 7 A. I did not -- 8 Well I compared my results to an experiment. 9 Q. Okay. But I'm talking about your 10 computational fluid -- your mathematical results. 11 A. Correct. 12 Q. Okay. For example, if I wanted someone on 13 my team to -- Well, strike that. 14 Part of the methodology in doing CFD is to 15 have a proper model; correct? 16 A. Yes. 17 Q. Proper boundary conditions; correct? 18 A. Yes. 19 Q. And you need to put in initial conditions; 20 correct? 21 A. That is correct. 22 Q. Okay. Without the initial -- 23 That is mandatory in a CFD analysis is 24 having initial conditions; correct? 25 A. That is correct.</p>

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<p style="text-align: right;">Page 254</p> <p>1 Q. And you have not provided the initial 2 conditions to the plaintiff in this case; correct? 3 MR. GOSS: Asked and answered multiple, 4 multiple times. 5 A. That is correct. 6 Now you can get the same results by having 7 different initial conditions. 8 Q. But the methodology requires initial 9 conditions; correct? 10 A. The methodology requires initial conditions, 11 it doesn't require the same ones. 12 Q. Let's go to your CFD model. 13 (Discussion off the stenographic record.) 14 (Files brought up on a projector.) 15 BY MR. ASSAAD: 16 Q. Now I'm going to represent to you that the 17 name of this file is Abraham 0000001, which is a Bates 18 number that -- your TRN file that is TRN 264. 19 MR. GOSS: Can you -- I'm not suggesting 20 that it isn't that, but can you give us, at the end 21 of the deposition, a thumb-drive copy? 22 MR. ASSAAD: Is there any way we can go to 23 the 264 TRN -- dot TRN number? 24 (Screen being manipulated.) 25 MR. GOSS: And I don't -- I don't question</p>	<p style="text-align: right;">Page 256</p> <p>1 Do you see that? 2 A. Yes. 3 Q. Okay. Does that look about right? 4 A. I never provided a plot or looked at a plot 5 with this temperature range, so I can't co -- I can't 6 confirm. 7 Q. Okay. But you agree with me that with the 8 TRN file that you provided that you could go in and 9 get temperature ranges such as this. 10 A. Yes. 11 Q. Okay. And I represent to you that this is 12 the temperature range along a certain plane along the 13 middle -- going down the middle of the body roughly of 14 the temperature differences in the room. 15 Do you see -- 16 MR. GOSS: I'm sorry. Is this something 17 that you did, or are you saying that she did it? 18 MS. ZIMMERMAN: This is off his -- 19 MR. GOSS: What's that? 20 MR. ASSAAD: Well let me -- 21 Q. You could produce many images off your TRN 22 file depending on what you're looking for; correct? 23 A. Correct. 24 Q. And this is the type of image that you could 25 pull off your TRN file; correct?</p>
<p style="text-align: right;">Page 255</p> <p>1 that it is, it's just can we get a copy of the file 2 after the deposition? 3 MR. ASSAAD: It's your file. So yeah, I 4 can give it back to you. 5 MR. GOSS: That's fine. Just so I can 6 verify. 7 BY MR. ASSAAD: 8 Q. Okay. Up there -- 9 And if you want to stand up and look closer, 10 feel free, but it says 264. And I represent that this 11 is your TRN file loaded into ANSYS software. 12 Does this look like ANSYS software to you? 13 A. Yes. 14 Q. And what I have here is the temperature 15 difference between -- 16 MR. ASSAAD: Let's go off the record real 17 quick. 18 (Discussion off the record.) 19 BY MR. ASSAAD: 20 Q. I'm sorry about that. I needed to get a 21 mobile microphone so I can move. 22 So this is your TRN file for time step 264. 23 And what I've put up on the screen is the temperature 24 distribution in the room with a -- a scale range of 58 25 degrees Celsius to 62.</p>	<p style="text-align: right;">Page 257</p> <p>1 A. That is correct. 2 Q. You just do a couple clicks in ANSYS, you 3 tell them what you need, you draw a plane where you're 4 looking and you could produce this image; correct? 5 A. Correct. 6 Q. Okay. And you agree with me that when you 7 put the temperature max of 62, the red area is all 8 temperatures 62 degrees and above; correct? 9 A. Yes. 10 Q. And you agree with me that based on your 11 initial conditions and that the air coming from the 12 ceiling inlet of being 59 degrees, that the low 13 temperature would probably be 59 degrees in the 14 operating room; correct? 15 A. Correct. 16 Q. Okay. And this would be the temperature 17 difference between the ceiling and the floor; correct? 18 A. Well you're showing the temperature 19 distribution on a cross-section. 20 Q. Yes. 21 A. And that temperature distribution goes from 22 the ceiling to the floor. 23 Q. Okay. And you agree with me that there's 24 very little difference between the temperature of the 25 ceiling and the temperature of the floor.</p>

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<p style="text-align: right;">Page 258</p> <p>1 A. There is a few degrees difference. 2 Q. Okay. And we could actually go in and pick 3 points and determine the temperature difference; 4 correct? 5 A. Yes. 6 Q. Okay. I could go pick a point up at the 7 ceiling and I could go pick a point up at the bottom 8 and it'll give me the temperature difference; correct? 9 A. Correct. 10 Q. Do you know what the temperature difference 11 in an operating room is between the ceiling and the 12 height of the operating room table? 13 A. No. It would depend on where you are in the 14 room, because the temperature difference would not be 15 constant. It would not be the same depending on where 16 you took the measurements. 17 But no, I do not know, as a general rule, 18 the temperature difference between the ceiling in the 19 OR. 20 Q. By the way, have you looked at any studies 21 that did temperature monitoring of an operating room 22 when the Bair Hugger was on as compared to the Bair 23 Hugger was off? 24 A. Yes. 25 Q. Would that be the Dasari study?</p>	<p style="text-align: right;">Page 260</p> <p>1 A. Yes. 2 Q. Okay. And say if they were comparing two 3 devices. Say, for example, the difference between the 4 Bair Hugger and the HotDog, okay? Everything's 5 identical except one was the Bair Hugger was on, and 6 one was that the HotDog was on, would you agree with 7 me that if there was a Delta T between the temperature 8 measurements you could say that was as a result of the 9 differences in the devices? 10 MR. GOSS: Same objection. 11 A. I would agree to this and the prior question 12 with the caveat that the -- any heat generated in an 13 OR may create a change in the control system of the 14 HVAC. So the HVAC may turn on or off or turn higher 15 or lower depending on heat, but aside from that 16 caveat, I agree. 17 Q. Okay. And have you looked at any studies 18 that show the difference in the temperature increase 19 around the surgical table between the Bair Hugger and 20 the HotDog? 21 A. Yes. 22 Q. What study? 23 A. It may -- I -- I know this isn't a memory 24 test and you're not making me do a memory test. It 25 could be the two I mentioned, the Legg studies. It</p>
<p style="text-align: right;">Page 259</p> <p>1 A. That was one. 2 Q. What was the other one? 3 A. (Witness reviewing exhibit.) If I recall 4 correctly, it was the Legg papers. 5 Q. Okay. Would you agree with me that a study 6 that was identical with the number of people in an 7 operating room, same flow, same operating room, and 8 the only thing that changed was whether or not the 9 Bair Hugger was used or not used and measured 10 temperature difference would indicate the temperature 11 rise in the operating room solely because of the Bair 12 Hugger? 13 A. Boy, that was complex. 14 Could you rephrase it in a shorter, tighter 15 -- 16 Q. If there's a study which everything is 17 identical; the number of people in the room, the 18 airflow, the devices, the equipment, but the only 19 thing that changed was the Bair Hugger was on as 20 compared to the Bair Hugger was off, would you agree 21 with me that any change in the temperature in that 22 room would be a result of the Bair Hugger? 23 A. Yes. 24 MR. GOSS: Object to the incomplete 25 hypothetical.</p>	<p style="text-align: right;">Page 261</p> <p>1 could be Dasari. I just don't remember which one. I 2 remember that there were -- there are two studies in 3 my memory that looked at temperature changes over the 4 surgical site, and I believe one of them did a 5 comparison of the HotDog and Bair Hugger. 6 Q. And do you recall that study showing that 7 when the Bair Hugger was used the temperature around 8 the surgical table was higher than when the HotDog was 9 used? 10 A. Can you show me the study? 11 Q. I'm asking if you recall that? 12 A. I don't recall. 13 Q. Okay. Assuming that when the Bair Hugger's 14 used that the temperature around the surgical site is 15 higher -- or the surgical table is higher than when 16 the HotDog is used and everything else stayed 17 constant, what would that indicate to you as a 18 scientist? 19 MR. GOSS: Objection, incomplete 20 hypothetical. 21 A. I mean you're asking me to comment on a 22 study that I don't have in front of me so I'd have to 23 read the study. 24 Q. I'm just saying -- Forget about the study. 25 In a hypothetical situation that you have a</p>

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<p style="text-align: right;">Page 262</p> <p>1 HotDog -- 2 You know what the HotDog is? 3 A. Yes. 4 Q. And you have a Bair Hugger. You know what a 5 Bair Hugger is; correct? 6 A. Yes. 7 Q. Okay. And everything else is constant 8 except in one -- in certain tests the HotDog is used, 9 and in other certain tests the Bair Hugger is used, 10 and when you compare the results it shows a statis -- 11 statistic -- signi -- a statistic -- 12 MR. GOSS: Ly [lee]. 13 Q. -- statistically significant change between 14 the Bair Hugger and the HotDog showing that the Bair 15 Hugger warms the air around the operating room table 16 more than the HotDog. 17 Assuming those facts, what does that mean to 18 you as a scientist as to the effect of the Bair Hugger 19 compared to the HotDog on the temperature around the 20 surgical table? 21 MR. GOSS: Same objection, assumes facts 22 not in evidence. 23 A. If that is correct, and part of the reason 24 why I'm tentatively answering this is there have been 25 multiple studies that I've read that actually show</p>	<p style="text-align: right;">Page 264</p> <p>1 temperature around the operating room table more than 2 the HotDog, you would agree with me that the increase 3 in temperature over the operating room table is most 4 likely due to the heat coming from the Bair Hugger. 5 MR. GOSS: Objection, incomplete 6 hypothetical. 7 A. It's possible, but there are other 8 alternative explanations. 9 Q. Are there other heat sources that -- that -- 10 A. Yes. 11 Q. -- are different if I say everything else is 12 constant besides the Bair Hugger and the HotDog? 13 MR. GOSS: Same objection. 14 A. Let me give you two options. Let me give 15 you just two alternatives to show that it's not a 16 simple question without seeing the study in front of 17 me. 18 Let's say the Bair Hugger initiated less of 19 a temperature response in the HVAC system and that 20 lesser response meant that there was less airflow 21 coming out of the vents. That could be a reason. 22 Q. Is it your understanding that the mass flow 23 out of the vents in an operating room can change? 24 A. It may. I would have to see the H -- the 25 control system, but it could.</p>
<p style="text-align: right;">Page 263</p> <p>1 conflicting measurements of temperature above the 2 table, they show different values, so I wouldn't 3 assume that that study is correct. But if it is 4 correct, one interpretation may be that there is heat 5 from the Bair Hugger that is entering the air. That's 6 one possibility. 7 Q. What's the other possibility? 8 A. There is -- could be draping, it could be 9 the measurement method is different. I would have to 10 look at the study. You're asking me to comment -- 11 Q. Well when you compare -- 12 MR. GOSS: Hold on. Let him finish his 13 answer. 14 A. You're asking me to comment on a study that 15 I don't see, and I know that there are multiple 16 studies that are conflicting on these very types of 17 measurements that you've made. 18 Q. With respect to temperature measurements? 19 A. Yes. 20 Q. Okay. We'll get to that in a second. 21 But if everything is constant; where the 22 temperature measurements are taken, the airflow, the 23 number of people, okay? There's no change. The only 24 thing that's changed is the HotDog and the Bair 25 Hugger, and the Bair Hugger shows an increase in</p>	<p style="text-align: right;">Page 265</p> <p>1 Q. Do you know the entire purpose of the 2 unidirectional airflow is a constant velocity of air 3 being -- coming out of the inlets over the surgical -- 4 over the surgical table. You understand that; 5 correct? 6 A. I do not under -- 7 MR. GOSS: Object to form. 8 A. I do not understand that. 9 Q. You're not aware of that fact? 10 MR. GOSS: Object to form. 11 A. What I understand -- 12 Q. Are you not aware of that fact? 13 MR. GOSS: Same objection. 14 A. Are you saying constant in time or constant 15 in space? 16 Q. Well you -- you take the face velocity of I 17 believe 39 feet per sec -- feet cubed per second. Do 18 you recall that? 19 A. Yes. That is not a face velocity, but yes, 20 I recall that number. 21 Q. You're right, it's not. It's a volumetric 22 velocity. 23 Do you believe that number changes over time 24 in an operating room? 25 A. Certainly it would. There is no perfect</p>

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<p style="text-align: right;">Page 266</p> <p>1 ventilation system where the flow is always the exact 2 same value. 3 Q. I understand that it's a tolerance and 4 there's going to be a deviation, but do you -- do you 5 believe that the controls of the HVAC system in an 6 operating room may change the volumetric flow? 7 A. I don't know the answer to that -- 8 Q. Okay. 9 A. -- but it -- they may. 10 Q. But you don't know sitting here today. 11 A. Correct. 12 Q. So again I don't want you to guess, so you 13 could say "I don't know"; right? You can say those -- 14 You know how to say "I don't know." If you don't 15 know, you don't know; correct? 16 A. I do know how to say I don't know. 17 Q. Okay. Now let's look at your 3D model, and 18 -- 19 MR. ASSAAD: Can you put up the boundary 20 condition for the outlet... 21 (Discussion off the stenographic record.) 22 (Change in projected image.) 23 MR. GOSS: Are we in ANSYS right now? 24 MR. ASSAAD: Let me ask the doctor. 25 BY MR. ASSAAD:</p>	<p style="text-align: right;">Page 268</p> <p>1 A. Yes. 2 Q. Okay. So even though you might be 3 incorrect, I could rely on your TRN file for the 4 boundary conditions, the time step, the material 5 properties, the airflow, et cetera. 6 A. Yes. 7 Q. Okay. Now my understanding is that the 8 entire mass flow -- the entire mass flow of the Bair 9 Hugger unit is coming out of that area that looks -- 10 that's red. 11 A. Yes. 12 Q. Okay. And on top of it is a drape; correct? 13 A. Correct. 14 Q. And the drape -- the drape is adiabatic; 15 correct? You set it as adiabatic. 16 A. Correct. 17 Q. Therefore there's no heat transfer from that 18 Bair Hugger inlet to the drape; correct? 19 A. Correct. 20 Q. And that's not what happens in real life; 21 correct? 22 A. That is different from real life. 23 Q. So -- Okay. Real life there'll be some heat 24 transfer and actually convective -- or plumes above 25 the drape; correct? There'll be convective currents</p>
<p style="text-align: right;">Page 267</p> <p>1 Q. Doctor, does this look like ANSYS? 2 A. Yes. 3 Q. Do you have any dispute that this is not 4 ANSYS? 5 A. No. 6 MR. GOSS: I'm not disputing it, I just 7 wanted to know. 8 Q. Do you agree that -- 9 MR. ASSAAD: Turn it so I can see -- 10 Q. Do you agree that the red area is the 11 boundary condition for the Bair Hugger inlet? 12 A. I do. 13 Q. Okay. And you agree that's mostly coming 14 from the back -- underneath the drape and the back of 15 the patient. 16 A. I do, which reminds me that I gave an 17 incorrect answer earlier today where I had recalled it 18 came from both. But seeing it re -- seeing it here, 19 it's clearly predominantly the back. 20 Thank you. 21 Q. Now we could agree that the -- the -- I 22 mean, you might remember and not remember stuff, we 23 always can go back to the TRN file to get the geometry 24 and the mesh and everything; correct? And the 25 boundary conditions.</p>	<p style="text-align: right;">Page 269</p> <p>1 above the drape as a result of the change in 2 temperature of the drape. 3 A. I disagree. 4 Q. You disagree? 5 A. Yes. 6 Q. Okay. So you disagree with Gary Settles, 7 who did schlieren testing that showed that there was 8 thermal convection above the drape. 9 A. Well there's thermal convection everywhere 10 in the room. 11 Q. Okay. But you disagree that the Bair Hugger 12 caused thermal convection above the drape as Gary 13 Settles has testified. 14 MR. GOSS: Objection, lack of foundation. 15 A. When you -- 16 MR. GOSS: If you know, you can answer. 17 A. When you use the words "thermal convection" 18 and "above the drape," what do you mean by "above the 19 drape"? 20 Q. Okay. The Bair Hugger is going to heat the 21 drape, correct, in real life. 22 A. It may. 23 Q. Okay. The Bair Hugger air is coming out at 24 41 degrees Celsius according to what you've put down; 25 correct?</p>

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<p style="text-align: right;">Page 270</p> <p>1 A. Correct.</p> <p>2 Q. And the drape is a cloth drape, a surgical</p> <p>3 drape; correct?</p> <p>4 A. Correct.</p> <p>5 Q. You would agree by the law of thermodynamics</p> <p>6 that there'll be -- and heat transfer that there's</p> <p>7 going to be some heat transfer to the drape; correct?</p> <p>8 A. Pardon me. (Witness reviewing exhibit.)</p> <p>9 Q. I'm not talking about your report here.</p> <p>10 Let's just talk about engineering principles.</p> <p>11 MR. GOSS: Okay. But if he needs to refer</p> <p>12 to his report to answer --</p> <p>13 MR. ASSAAD: I am not talking about his</p> <p>14 report, sir. I'm talking about this picture up here</p> <p>15 and common heat transfer.</p> <p>16 MR. GOSS: You have plenty of time left on</p> <p>17 the tape to get an answer. You can answer when</p> <p>18 you're ready.</p> <p>19 MR. ASSAAD: Okay.</p> <p>20 A. If sufficient amount of warm air presses</p> <p>21 against -- touches that drape, then I agree there</p> <p>22 would be heat transfer between the air and the drape.</p> <p>23 Q. Did you look at the drapes actually? Did</p> <p>24 you touch the drapes?</p> <p>25 A. Yes.</p>	<p style="text-align: right;">Page 272</p> <p>1 of that inlet --</p> <p>2 (Screen image modified.)</p> <p>3 THE WITNESS: Thank you.</p> <p>4 A. I would agree with you that the exact shape</p> <p>5 of that inlet shown in red would differ slightly from</p> <p>6 in actual practice. I agree.</p> <p>7 Q. "Slightly"? Or --</p> <p>8 Do you know, sitting here today?</p> <p>9 A. Well I will say this. I don't think the cha</p> <p>10 -- the difference would have a material impact on the</p> <p>11 results.</p> <p>12 Q. I understand that's your opinion, sir. But</p> <p>13 let's just not make --</p> <p>14 I don't want to know about what your</p> <p>15 opinions on the results. I just want to know, do you</p> <p>16 know whether or not that drape shape is accurate,</p> <p>17 sitting here today?</p> <p>18 A. That drape shape would not be perfectly</p> <p>19 accurate.</p> <p>20 Q. Okay. Did you take any measurements of the</p> <p>21 shape, or pictures?</p> <p>22 A. No.</p> <p>23 Q. And in fact you did not even create this;</p> <p>24 did you?</p> <p>25 A. Correct.</p>
<p style="text-align: right;">Page 271</p> <p>1 Q. The drapes are -- they have no form to them,</p> <p>2 they're just like a drape, like a blanket; correct?</p> <p>3 A. Correct.</p> <p>4 Q. Okay. And when you put the drape on a</p> <p>5 patient do you get that same type of nice curvature</p> <p>6 shape that has an open area to the back of the</p> <p>7 patient?</p> <p>8 A. No.</p> <p>9 Q. Okay.</p> <p>10 A. It is not exactly that shape.</p> <p>11 Q. Okay. Because gravity is going to be</p> <p>12 pulling that drape down; correct? Unless something's</p> <p>13 holding it up.</p> <p>14 A. Well the drape is held up by clips.</p> <p>15 Q. Not that drape. That drape -- I don't see</p> <p>16 any clips here on this drape. This drape, the white</p> <p>17 line is held up by clips; correct?</p> <p>18 A. I agree. I thought that's the drape we were</p> <p>19 talking about.</p> <p>20 Q. This drape I'm talking about here.</p> <p>21 [Indicating.] This drape is not being held up by</p> <p>22 anything; correct?</p> <p>23 A. It's hard for me to identify a different</p> <p>24 drape than that drape in this image. I mean, I would</p> <p>25 -- look, I would agree with you that the exact shape</p>	<p style="text-align: right;">Page 273</p> <p>1 Q. Okay.</p> <p>2 A. I did not create it.</p> <p>3 Q. 3M created this; correct?</p> <p>4 A. 3M created the geometry.</p> <p>5 Q. Which is the shape of the -- of the Bair</p> <p>6 Hugger inlet.</p> <p>7 A. Yes.</p> <p>8 Q. Okay. You never did any measurements, you</p> <p>9 yourself or anyone on your team, to determine the</p> <p>10 shape of the Bair Hugger inlet; correct?</p> <p>11 A. That is correct.</p> <p>12 Q. Okay. So sitting here today, you cannot</p> <p>13 independently verify the shape of that Bair Hugger</p> <p>14 inlet, you're relying on what 3M has provided to you.</p> <p>15 A. I relied, for the three dimensional object</p> <p>16 -- all the three dimensional objects, on what 3M</p> <p>17 provided to me.</p> <p>18 Q. So you, sitting here today, cannot</p> <p>19 independently verify that shape, you are relying on</p> <p>20 what 3M has provided to you.</p> <p>21 MR. GOSS: Asked and answered.</p> <p>22 A. Correct.</p> <p>23 Q. Okay. Now based on this geometry it was 3M</p> <p>24 that came up with the assumption of the Bair Hugger</p> <p>25 inlet; correct?</p>

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<p style="text-align: right;">Page 274</p> <p>1 A. No. 2 Q. "No"? 3 A. That was my decision. 4 Q. If you look at the geometry file provided by 5 3M, that red area is titled "Bair Hugger inlet"; 6 correct? 7 A. I don't know if it is. But the decision to 8 have the hot air enter into the room from that surface 9 was my decision regardless of the name on the file. 10 Q. Okay. But did you change the Bair Hugger 11 inlet if 3M created it? 12 A. I did not change the Bair Hugger inlet. 13 Q. So you accepted their -- 14 You looked at what they did and you 15 determined that that assumption is correct. 16 A. I determined that that assumption is 17 reasonable, yes. 18 Q. Okay. And by "reasonable" you mean correct. 19 A. Correct enough to -- 20 Q. Okay. 21 A. -- answer the question I was trying to 22 answer. 23 Q. Okay. 24 (Discussion off the stenographic record.) 25 Q. You agree with me that this is -- what's</p>	<p style="text-align: right;">Page 276</p> <p>1 that's red. 2 A. Yes. 3 Q. Okay. So if I could look from underneath 4 this table and I see an opening to where the arms are, 5 you're saying that no air is -- no hot air is going to 6 come down the side of this drape over here 7 [indicating]. 8 A. It is highly unlikely. 9 Q. What's your scientific basis behind that? 10 A. As I've explained earlier in this 11 deposition, the way this device works in a setup like 12 this is the arms are out, could be two arms or it 13 could be one arm. The Bair Hugger is in a blanket 14 that is inflated with warm air and there are tubes 15 that run along the arm. Those tubes wrap around the 16 arm, and that wrapping is facilitated by the covering, 17 the cotton blanket and the other draping. Out of that 18 Bair Hugger blanket small jets of air hit the skin and 19 then essentially stop, so you have a stagnant zone of 20 warm air. It is my professional opinion -- Well it's 21 more than my professional opinion that that stagnant 22 air wants to rise. It is my professional opinion that 23 it takes, as one of the other experts said, the path 24 of least resistance and it will want to go along a 25 vertical channel, and that would be along the arm</p>
<p style="text-align: right;">Page 275</p> <p>1 shown up on the screen is a depiction of a patient in 2 a hip arthroplasty surgery. 3 A. Yes. 4 Q. Okay. And that is when he's on the side and 5 both of his hands are pointed, and in this case to the 6 left direction. 7 A. Correct. Or her hands. Correct. 8 Q. Her hands. I apologize. 9 To play it safe I'll use "the patient's 10 hands." 11 And the Bair Hugger blanket is going over 12 the entire -- Rephrase that. 13 On the right-hand side the Bair Hugger 14 blanket, we can agree, is being tucked in underneath 15 the table, or the pad. 16 A. Correct. 17 Q. And on the left-hand side we agree that the 18 Bair Hugger blanket is being -- is going over the -- 19 the arms of the patient; correct? 20 A. Correct. 21 Q. And it's being tied down; correct? 22 A. Correct. 23 Q. Okay. And just so I understand, it is your 24 assumption that no matter where the air comes out of 25 the Bair Hugger that it ends up coming out of the area</p>	<p style="text-align: right;">Page 277</p> <p>1 because there are channels, there are spaces, and then 2 out through the head and neck area. Now -- 3 Q. Do you take into -- 4 While you answer this question do you take 5 into account that it's -- there's still jets of air 6 pushing down at all times? 7 A. Yes. 8 Q. Okay. 9 MR. GOSS: Were you finished with your 10 earlier answer? 11 THE WITNESS: What I was going to add is 12 that it is likely, and I would say certain, that the 13 warm air would emerge from an area which may not be 14 identical to that red area exactly, but it would be 15 close enough so that the calculations are valid. 16 Q. And that is the assumption that there is an 17 opening where that red is for the air to escape; 18 correct? 19 A. Incorrect. What I said in my statement was 20 that the air would travel up the natural channels that 21 exist between the blanket and the body and it would 22 emerge by the head or neck area. I concede, and I 23 conceded in my last answer, that the area through 24 which the air ultimately enters the room would likely 25 not be exactly that red area. In fact some of that</p>

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<p style="text-align: right;">Page 278</p> <p>1 air would emerge by the chest and neck, by the chin. 2 So there would be some differences, but they would be 3 immaterial to the results of the analysis. 4 Q. Would you agree with me, though -- I mean 5 you've seen Gary Settles' measurements; correct? 6 A. Yes. 7 Q. And when the Bair Hugger was turned on, and 8 this was in a warehouse with no people around, that 9 the temperature underneath the operating room table 10 increased. 11 MR. GOSS: Objection to form, lack of 12 foundation, misstates the evidence. 13 A. I think what he said is the temperature 14 underneath the drapes and perhaps underneath the 15 arm-boards, but I would a -- with that caveat, I would 16 agree. 17 Q. So if the temperature under the arm-boards 18 increased, that means the heat is -- not all the 19 heat's going up through the channels and out the area 20 that you say it goes out; correct? 21 A. It is correct that not all the heat, but 22 let's not confuse "heat" with "air." 23 Q. Okay. Well maybe that's where our issue is 24 here, and maybe we're coming to the final, like, area 25 we disagree.</p>	<p style="text-align: right;">Page 280</p> <p>1 A. What Gary Settles showed -- 2 Well first of all, he said he did not know 3 whether there is air that actually went beneath the 4 arm-boards. That's my best reco -- 5 Q. I'm not talking heat -- 6 I'm not talking air, we're talking about 7 heat. 8 A. Okay. 9 Q. Heat. 10 A. Okay. If temperatures are higher below the 11 arm-board, if temperature measurements are higher, 12 what are the possible explanations? One explanation 13 is what you've just articulated, that hot air may get 14 below the arm-boards. That's an explanation. Another 15 explanation is that heat, as you pointed out, and I 16 neglected this in my model, heat conducts through 17 solids. Heat would conduct through the arm-board and 18 that heat would end up on the undersurface of the 19 arm-board. A third explanation is that he reported he 20 put the -- a thermocouple or a thermal sensor under 21 the drape and underneath the arm-board somewhere. If 22 his thermal sensor was between the drape and the 23 arm-board, or if it was in visible sight of the drape, 24 the sensor was warmed by infrared radiation. And 25 remember, sensors sense the temperature around them,</p>
<p style="text-align: right;">Page 279</p> <p>1 Just because air travels up doesn't mean all 2 of the heat is transferring with the air to -- to the 3 -- not all the heat's being exited out of the red area 4 here on the diagram; correct? 5 A. I agree. 6 Q. Okay. In fact, in real life heat's going to 7 be transferred to the drapes around it; correct? 8 A. Could be. 9 Q. It's going to be transferred definitely to 10 the patient, because that's the purpose of the Bair 11 Hugger. 12 A. Yes. 13 Q. Okay. It's going to be transferred to 14 probably the arm-boards a little bit; correct? 15 A. Yes. 16 Q. Okay. And if the flow is not fast enough, 17 it's going to be -- it's going to start transferring 18 hot air -- the air below the -- the arm-board is going 19 to increase over time until it reaches steady state 20 based on the flow of air escaping and the amount of 21 heat that's being transferred. Correct? 22 A. No. 23 Q. Well -- 24 A. That's not the only explanation. 25 Q. What's the other explanation?</p>	<p style="text-align: right;">Page 281</p> <p>1 they don't sense their own temperature. 2 So there's other explanations, -- 3 Q. Okay. 4 A. -- including the one you've given, about how 5 the undersurface of the arm-board could warm. 6 Q. Okay. And if you gave material properties 7 to the patient, and to the arm-board, and to the 8 drapes, your model would be able to show where the 9 heat is going to; correct? 10 A. My model would be able to show heat 11 conduction through solids, if that's what you mean. 12 Q. And heat conduction through air. 13 A. My model does show heat conduction through 14 air. 15 Q. Okay. Okay. I understand that. 16 But you agree with me -- 17 But -- But since you made the board 18 adiabatic, the drape adiabatic, and all the -- and 19 everything in that room adiabatic except for air, we 20 can't see the transfer of heat to the arm-board, to 21 the drapes, and then its effect on the air below the 22 operating room table; correct? 23 A. We cannot see conductive heat transfer. 24 However, you have to recognize that this model was a 25 replication of an actual OR, and in an actual OR what</p>

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<p style="text-align: right;">Page 282</p> <p>1 I recall from the setup was there was an arm, there 2 was a pillow, then there was another arm and the 3 blanket wrapped around. 4 I made a judgment that the heat would not 5 transfer through the pillow. I don't know if Gary 6 Settles had an insulating pillow in his experiment. I 7 don't know if he provided that detail or perhaps my 8 memory's faulty. 9 Q. Well you've read his report; correct? 10 A. Yes. 11 Q. And I asked you if his data in his report's 12 reliable, and you said "yes." And now you're sitting 13 here telling me that you don't know how he took 14 temperature measurements? 15 MR. GOSS: Object to form. 16 A. No, that's not what I'm telling you. 17 Q. Well do you know where he took the 18 temperature measurements? Did he take them between 19 the arm and the -- and the board -- and the arm-board? 20 MR. GOSS: Lack of foundation. If you have 21 a -- 22 Q. If you don't know, remember you can just say 23 the words "I don't know." 24 A. What Gar -- 25 What I recall Gary Settles saying, Dr.</p>	<p style="text-align: right;">Page 284</p> <p>1 A. Yes. 2 Q. Okay. So if I put a 1600 BTU heater in this 3 corner and turn it on, it might take time until you 4 feel its effects where you're sitting in the 5 deposition chair; correct? 6 A. I agree. 7 Q. Okay. So time is definitely a factor with 8 respect to heat flow. 9 A. It can be. 10 Q. Okay. Well again, with heat flow it would 11 take time for this room with a 1600 BTU heater, 12 powered heater, to come to a steady state in this 13 room; correct? 14 A. I agree. 15 Q. Okay. And you agree with me that when you 16 turn the Bair Hugger on it's going to take some time 17 for the area -- if the area under the floor board is 18 heated, to reach steady state; correct? 19 MR. GOSS: "Under the floor board"? 20 MR. ASSAAD: Or under the arm-board. 21 A. I would agree. 22 Q. Okay. And depending on when you take that 23 measurement, unless you're absolutely certain you're 24 at steady state it might not be the max temperature 25 underneath the arm-board; correct?</p>
<p style="text-align: right;">Page 283</p> <p>1 Settles saying, is that the temperature measurement 2 was made under the drape, so clearly under the drape. 3 What I recall him saying was that the temperature 4 underneath the arm-board was warmer. 5 Q. 28 degrees Celsius; correct? At one point. 6 A. I believe that was the maximum. 7 Q. Okay. 26 to 28 degrees Celsius depending on 8 where he took it; correct? 9 A. That is what I recall. 10 Q. Okay. So -- 11 A. What Gary Settles -- 12 Q. -- it definitely shows that heat is getting 13 underneath the arm-board; correct? 14 MR. GOSS: Hold on. 15 A. What Gary Settles was trying to do was to 16 explore the veracity of Elghobashi's boundary 17 conditions by looking at temperatures. As I 18 understand it, and if I'm wrong I'm happy to admit I'm 19 wrong. As I understand it, he was looking to see if 20 he could find temperatures of 41 degrees Celsius under 21 the table as reported by Elghobashi, and that was the 22 intent of his study. In that respect it is reliable. 23 Q. You agree with me that if you put a heat 24 source in a room, its change in the temperature in the 25 room is relative to time; correct?</p>	<p style="text-align: right;">Page 285</p> <p>1 A. Correct. 2 Q. Okay. And do you recall his deposition in 3 which he could not identify any of the times that he 4 took the temperature measurements? 5 MR. GOSS: Object to form, lack of 6 foundation. If you remember from reading the 7 transcript, you can indicate as much. 8 A. I don't recall that. 9 Q. Okay. And the fact that -- 10 MR. ASSAAD: Let's turn this upside down so 11 I can see looking straight down. 12 (Image manipulated.) 13 MR. ASSAAD: Okay. Right there is perfect. 14 Q. You agree with me that there is an opening 15 to the arm-board in your model right underneath right 16 here; correct? 17 MR. GOSS: Can you tell me what we're 18 looking at right now? I'm sorry. 19 Q. Do you know what we're looking at, Dr. 20 Abraham? 21 A. It's hard for me to see from this side of 22 the room. 23 Q. All right. Feel free to get closer. 24 MR. GOSS: I don't -- I can't tell how you 25 oriented it. I could understand what we were looking</p>

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<p style="text-align: right;">Page 286</p> <p>1 at and then you tilted it, and now are we looking at 2 from the ceiling down? 3 MR. ASSAAD: From the floor up. 4 MR. GOSS: From the floor up. Thank you. 5 MR. ASSAAD: And you could notice by the 6 X/Y coordinates here. 7 MR. GOSS: If I knew anything about that I 8 could, that's true. 9 Q. You agree with me you're looking from the 10 floor up; correct? 11 A. I agree. 12 MR. GOSS: Thank you. 13 Q. Okay. And if you are looking from the floor 14 up, you see that there's a pathway to that arm-board 15 that's in that little area here. Do you agree? 16 A. Could you color the body so that I can -- 17 Everything is blue now and I can't distinguish between 18 different features. 19 Okay. So we're not looking at the body. 20 Q. I said the arm-board. 21 MR. ASSAAD: Can you get a better view of 22 the... 23 (Image manipulated.) 24 BY MR. ASSAAD: 25 Q. I mean, based on the geometry do you agree</p>	<p style="text-align: right;">Page 288</p> <p>1 There's no such thing as a mass flow of 2 heat. 3 Q. Well there's a mass flow of air; correct? 4 A. Correct. 5 Q. And there's heat -- 6 And that air's heated to 41 degrees Celsius; 7 correct? 8 A. Correct. 9 Q. And it's coming out perpendicular to that 10 boundary; correct? 11 A. I don't recall if I set the velocity to be 12 perpendicular, but I would agree it comes out of the 13 boundary. 14 Q. Okay. It comes out of the boundary. 15 There is no -- There's nothing in your model 16 of hot air around the arms; correct? 17 A. Correct. 18 Q. There's no flow of hot air on the arms; 19 correct? 20 A. I did not model the flow of the jets hitting 21 the arm, that is correct. 22 Q. You agree with me that if you did model 23 that, of hot air around the arms, that when we looked 24 at the underside, the view going from the floor to the 25 ceiling, that you'd see a change of temperature in</p>
<p style="text-align: right;">Page 287</p> <p>1 that that's the arm-board? 2 A. I would agree. 3 Q. Okay. And you agree with me that it looks 4 like you could see into where the drape is there's an 5 open area there; correct? 6 A. We can visually see that on the screen. 7 Q. Okay. 8 A. But it's not necessary that there's a flow 9 path. 10 Q. Well the reason why there's -- 11 You can sit down. 12 The reason why -- 13 MR. ASSAAD: Let's go back to the boundary 14 condition. 15 (Discussion off the stenographic record.) 16 (Image manipulated.) 17 Q. You agree with me that -- 18 MR. ASSAAD: A little more to the right so 19 I can see some red. To the right. Other way. Okay. 20 (Image manipulated.) 21 Q. You agree with me that the boundary 22 condition set for the Bair Hugger inlet is for a mass 23 flow of heat going out of the inlet, correct, 24 perpendicular? 25 A. A mass flow --</p>	<p style="text-align: right;">Page 289</p> <p>1 that area. 2 A. Not necessary. 3 Q. Not necessarily? Okay. 4 MR. GOSS: Well wait. Did you say "not 5 necessarily" or "not necessary"? 6 THE WITNESS: Not necessarily. 7 MR. GOSS: Okay. Thanks. 8 Q. So you're telling me if I have hot air 9 blowing at 41 degrees Celsius on my hand, okay, and 10 I'm looking at it and it's coming -- 11 Air is fluid; correct? 12 A. Air is a fluid. 13 Q. -- and if I'm looking at it from the bottom 14 I'm not going to see a change in temperature in this 15 area [indicating]? 16 A. That's not what I'm saying. 17 Q. What are you saying, then? 18 A. Remember -- and I believe this is true with 19 Dr. Elghobashi's model as well -- I did not model the 20 solids, which means if you look up from the bottom 21 you're not going to see the temperature of the air. 22 So I am not saying -- I will agree with you 23 that if I modeled the air jets impinging on the skin, 24 if I modeled that air region you would see it. 25 Q. But you did model the air; correct?</p>

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<p style="text-align: right;">Page 290</p> <p>1 A. Yes.</p> <p>2 Q. Well there's air around the board; correct?</p> <p>3 A. There is air in the blanket, and between the</p> <p>4 blanket and the skin.</p> <p>5 Q. Okay. And some of the air goes around the</p> <p>6 board; correct?</p> <p>7 A. I disagree.</p> <p>8 Q. You disagree. Okay.</p> <p>9 Is there any basis, scientific basis why you</p> <p>10 disagree except that based on your experience --</p> <p>11 A. Yes.</p> <p>12 Q. -- with forced-air warming blankets?</p> <p>13 A. Yes.</p> <p>14 Q. What's your basis?</p> <p>15 A. I'll try to do a better job of explaining</p> <p>16 it, because I think it's -- multiple times. I'm going</p> <p>17 to use my arm and --</p> <p>18 THE WITNESS: If you can't catch this on</p> <p>19 the screen, I apologize.</p> <p>20 A. The way the person is sitting they're laying</p> <p>21 like this. [Demonstrating.]</p> <p>22 Q. Is that how he's laying?</p> <p>23 A. Well it's essentially this. They've got two</p> <p>24 arms out to the side and is --</p> <p>25 Q. Is there anything between the arms?</p>	<p style="text-align: right;">Page 292</p> <p>1 Then what does it do? If you're hot air right here</p> <p>2 are you going to be able to go down to the bottom of</p> <p>3 the drapes and then emerge out into the room? That's</p> <p>4 possible. Or are you going to just migrate upwards</p> <p>5 along with buoyant forces? That is actually what</p> <p>6 happens. There is no physical mechanism that would</p> <p>7 force that stagnant warm air to go downwards to the</p> <p>8 floor and then come back up. It's the analogy that I</p> <p>9 used before; the match, or incense, or a cigarette.</p> <p>10 If you hold those things upside down, the smoke or the</p> <p>11 flame still rise.</p> <p>12 Q. Are you done?</p> <p>13 A. Yes.</p> <p>14 Q. Okay. Let's talk about heat, though. Are</p> <p>15 you saying all the heat's going to go out the head and</p> <p>16 neck?</p> <p>17 A. In my model all the hot air emerged by the</p> <p>18 head and neck. I did not allow heat to transfer by</p> <p>19 conduction, for example, through the arm-board.</p> <p>20 Q. Okay. And we know through Settles' results</p> <p>21 that heat does travel by conduction and heats up the</p> <p>22 -- the -- underneath the operating room table.</p> <p>23 A. We do --</p> <p>24 MR. GOSS: Object to form.</p> <p>25 A. -- not know that.</p>
<p style="text-align: right;">Page 291</p> <p>1 A. As I recall, there's a pillow.</p> <p>2 Q. Okay.</p> <p>3 A. Okay. There are blank --</p> <p>4 There is a hot warming blanket which wraps</p> <p>5 around the arm, and in fact I think a cartoon version</p> <p>6 of this was provided in Said Elghobashi's, maybe it</p> <p>7 was his supplemental report or something that I saw</p> <p>8 yesterday where he had these tubes around the arm.</p> <p>9 Okay? And that's -- that cartoon outlines this quite</p> <p>10 well, okay? So you have these tubes around the arm.</p> <p>11 The tubes have these little jets of air that are one</p> <p>12 millimeter in diameter, approximately. They hit the</p> <p>13 skin, they stop. We call that stagnation. So now you</p> <p>14 have a warm stagnant body of air.</p> <p>15 Now the question is, where does it go? If I</p> <p>16 have warm air near my hands, is that warm air going to</p> <p>17 travel up my arms and then out the open space by my</p> <p>18 head? And mind you there is air jets all along the</p> <p>19 way. So there's some air being -- hitting the arm</p> <p>20 here, and stagnating. There's other air hitting the</p> <p>21 arm here. There's other air hitting the arm here. A</p> <p>22 tiny amount is at the hands, but there's air all the</p> <p>23 way along, and in fact in the center part of the --</p> <p>24 the blanket. So you have air oozing out of this</p> <p>25 blanket very slowly, it hits the arms, it's stagnant.</p>	<p style="text-align: right;">Page 293</p> <p>1 Q. Okay. So you disagree with Settles.</p> <p>2 A. No.</p> <p>3 Q. Okay.</p> <p>4 A. I gave two explanations of how temperature</p> <p>5 measurements in the place he made them could be</p> <p>6 elevated, not -- one of them was not by conduction.</p> <p>7 Q. Okay. But regardless of what method it was</p> <p>8 heated, it was done by the Bair Hugger.</p> <p>9 A. I would agree.</p> <p>10 MR. GOSS: Lack of foundation. You can</p> <p>11 answer if you know.</p> <p>12 A. I would agree.</p> <p>13 Q. I mean, conservation of energy, you need a</p> <p>14 heat source to increase temperature; correct?</p> <p>15 A. I agree.</p> <p>16 Q. Okay.</p> <p>17 MR. GOSS: I'm sorry, Gabriel, can I take a</p> <p>18 bathroom break when you have a chance? Too much</p> <p>19 coffee.</p> <p>20 MR. ASSAAD: If I said "no," would you be</p> <p>21 upset?</p> <p>22 MR. GOSS: I'd be uncomfortable.</p> <p>23 MR. ASSAAD: You can take a break.</p> <p>24 MR. GOSS: Thanks.</p> <p>25 MR. ASSAAD: Off the record.</p>

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<p style="text-align: right;">Page 294</p> <p>1 THE REPORTER: Off the record, please. 2 (Recess taken from 5:09 to 5:16 p.m.) 3 BY MR. ASSAAD: 4 Q. So real quick a couple of things. Looking 5 at that picture up there if you look on the left side 6 it says -- it states, time, 1.2 seconds. Would you 7 agree with me that the file that you provided to us 8 was at a simulation time of 1.2 seconds? 9 A. No. I don't know if it was. That looks to 10 be an expression that was made, and I can't recall if 11 I made a time expression. Oh, I'm sorry. I thought 12 you were looking at the bottom. 13 Q. No. The right -- left-hand side -- 14 A. Yes. 15 Q. -- where it says "time." 16 A. I agree. 17 Q. Okay. So your model is basically a 18 simulation of 1.2 seconds; correct? 19 MR. GOSS: Object to form. 20 A. The results shown here -- 21 Q. Yes. 22 A. -- are the results after 1.2 seconds. 23 Q. Of simulation time. 24 A. Correct. 25 Q. Okay. Which is 1.2 seconds real time;</p>	<p style="text-align: right;">Page 296</p> <p>1 A. I have seen the CFD analysis on YouTube. 2 Q. And you've created the YouTube videos which 3 are about -- more than 1.2 seconds long; correct? 4 A. Correct. 5 Q. Okay. The fact that the video is -- say, 6 for example, is three minutes long of streamlines, or 7 two minutes, doesn't mean that you ran the model for 8 two minutes; correct? 9 A. That is correct. 10 Q. Okay. And so it's your opinion today that 11 you got quasi-steady state by running the model in 1.2 12 seconds. 13 A. Yes. 14 Q. Okay. Is it possible to run the model 15 forward based on the TRN file? 16 A. Yes. 17 Q. Without the initial conditions? 18 A. Correct. 19 Q. Now the fact that this is the 264th time 20 step, does that indicate to you what your time step 21 was? 22 A. No. I don't -- Looking at this here, I 23 don't see -- it doesn't tell me the time step and I 24 don't recall, sitting here. 25 Q. Can you determine the time step by looking</p>
<p style="text-align: right;">Page 295</p> <p>1 correct? 2 A. Correct. 3 Q. And as I understand it, the streamlines is a 4 line based on the instantaneous velocity at a 5 particular cell; correct? 6 A. Yes. 7 Q. Okay. It's not that you're following the 8 air around the operating room and seeing where that 9 particular air goes; correct? 10 A. It is an instant -- 11 What the streamline is is an instantaneous 12 -- 13 Let me tell you how streamlines are made. 14 The vectors which describe the flow direction and 15 speed are all obtained at a time instant and then they 16 are connected by their tangents, and that gives us 17 streamlines. So it's an instantaneous trajectory of 18 air. 19 Q. So one of the videos I believe lasted about 20 three minutes, or three and a half minutes long that 21 you provided in this case; correct? 22 A. I don't know that. 23 Q. Okay. Well the video is on YouTube. You've 24 seen your videos on YouTube that 3M has put on with 25 respect to your -- this CFD analysis.</p>	<p style="text-align: right;">Page 297</p> <p>1 at the ANSYS file? 2 A. Could you determine it? Yes, you could. 3 Q. How would you do that? 4 A. Well remember this file, the TRN file 5 contains everything, in the sense that it contains the 6 mesh, the geometry and the setup. So you could pull 7 it into the setup. 8 Q. So if I told you you could take over this 9 ANSYS program right now and determine the time step, 10 that's something you could do? 11 A. I may be able to. 12 Q. How long would it take you? 13 A. Boy, I don't know how long it would take me. 14 Q. Well where would you look? 15 A. I would load this thing into the CFX, what's 16 called the setup file, and I would look there. 17 Q. Okay. You used ANSYS Academic; correct? 18 A. Incorrect. 19 Q. "Incorrect"? 20 A. Incorrect. 21 Q. What did you use? 22 A. ANSYS Research. 23 Q. That's part of the Academics soft -- 24 package; correct? 25 A. I recall them being separate. I mean, if</p>

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<p style="text-align: right;">Page 298</p> <p>1 you show me documentation that they are part of a 2 single suite, then I would defer. But I recall ANSYS 3 Academic and Research as separate licenses and 4 separate software capabilities. 5 Q. So to determine the time step you would load 6 the TRN file into a CF -- CFX file -- 7 A. Correct. 8 Q. -- to the CFX setup program? 9 A. Yes. 10 Q. Okay. Now in some of your images it shows 11 "ANSYS 17.1 Academic," not on here but on the files 12 that you sent. Does that sound familiar? 13 A. No. I don't recall that. 14 Q. I'm going to show you on my computer, and we 15 could -- I'm just going to show it to you. This is 16 what's been provided to me, and it says "ANSYS R17.1 17 Academic;" is that correct? [Showing computer screen 18 to witness.] 19 A. Yes. 20 Q. Okay. Does that mean Academic that was 21 used? 22 A. Well it's my understanding, looking at that, 23 that it's the Research license that's -- I believe 24 that's what the "R" stands for, and as you pointed out 25 earlier, that may be part of the Academic suite, and</p>	<p style="text-align: right;">Page 300</p> <p>1 Greenberg Traurig to do your CFD; correct? 2 A. I don't know that. 3 Q. Who contacted you first? 4 A. I don't recall. 5 Q. Okay. But you have no disagreement that -- 6 that ANSYS Research is not allowed to be used for 7 consulting purposes. 8 A. I don't believe it is allowed to be used for 9 consulting purposes. 10 Q. You understand that you were contacted in 11 this case to do research with respect to a litigation 12 that was ongoing in 2015. 13 MR. GOSS: Object to form, mischaracterizes 14 his testimony. 15 A. I understand that I was contacted to 16 determine whether a device like the Bair Hugger would 17 interrupt operating-room airflow. I did understand 18 that it was part of a litigation. 19 Q. And in fact when you got -- you did your 20 experimental measures at -- at the OR, there were 21 lawyers there; correct? 22 A. That is correct. 23 Q. Okay. Are you aware of law firms contacting 24 universities to do research? 25 MR. GOSS: Just going to object to what</p>
<p style="text-align: right;">Page 299</p> <p>1 so I would concur. It appears as though it's the 2 Research portion of the Academic license. 3 Q. And you agree with me that the ANSYS 4 Research license is not allowed to be used for 5 consulting; correct? 6 A. I believe that is true. 7 Q. Okay. And you actually use it for 8 consulting; correct? 9 A. I disagree. 10 Q. So the fact that 3M was in litigation and 11 hired you as an expert to do the CFD study, you don't 12 -- that wasn't in your -- in a consulting role to 3M? 13 A. I was hired in an academic capacity to do 14 the CFD. 15 Q. You were hired by Lori Cohen and Greenberg 16 Traurig; correct? 17 MR. GOSS: Object to form. 18 A. I don't know who officially hired. 19 Q. Okay. 20 A. But my understanding is I was hired to do an 21 academic study, which is totally appropriate using the 22 Research license that I used. The expert witness work 23 is a separate issue, separate payment, and there's no 24 formal proposal. 25 Q. Okay. You were hired by the attorneys of</p>	<p style="text-align: right;">Page 301</p> <p>1 this may -- I don't see what this has to do with his 2 scientific opinions in this case, -- 3 MR. ASSAAD: Well it goes to his -- 4 MR. GOSS: -- but if you can answer the 5 question, then you may. 6 A. My understanding is 3M wanted to understand 7 the airflow in an operating room, and that's an 8 academic question with real academic significance. 9 That study was performed as we normally perform 10 studies where a fixed-cost grant proposal was given. 11 That study was the basis for the computational fluid 12 dynamics and for the journal paper publication. 13 Q. And all the consulting fees you were 14 receiving on behalf -- from 3M directly is from you 15 offering opinions based on that study done at St. 16 Thomas; correct? 17 A. No. 18 Q. Well all that we discussed about today and 19 all your opinions in this case is -- is with respect 20 to your CFD analysis of the problem. 21 A. That is incorrect. 22 Q. Okay. What else? 23 A. For example, I read a lot of literature, I 24 read depositions, I read expert reports, I performed 25 experiments. So to say that all of my opinions -- I</p>

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<p style="text-align: right;">Page 302</p> <p>1 -- To say, for example, my opinions about Said 2 Elghobashi's work, that was not based on my CFD, so -- 3 so it's incorrect to say that all of my opinions are 4 based on the CFD. 5 Q. Many of your opinions are based on the CFD 6 that you've given today; correct? 7 A. Some of my opinions are based on the CFD 8 work that we have discussed today. 9 Q. Well we've barely -- we rarely talked about 10 Elghobashi's report so far; correct? 11 A. That is correct. 12 Q. Okay. And you're using the results of your 13 CFD analysis in formulating your opinions regarding -- 14 some of your opinions in this case; correct? 15 A. I agree. 16 Q. Okay. And in fact you plan on testifying in 17 trial regarding the CFD analysis you performed in this 18 case; correct? 19 A. I am prepared to testify in trial based on 20 these CFD results. 21 Q. And that's not research, that's consulting; 22 correct? 23 A. Well that would be unpaid consulting, but 24 yes. 25 Q. Okay. Because you're not getting paid for</p>	<p style="text-align: right;">Page 304</p> <p>1 and 26, and 27 and 28, those are the diagrams and 2 pictures of the OR that's represented in your CFD 3 model; correct? 4 A. I believe that's true. 5 Q. Okay. And the geometry which is on page 6 Wagner 28 is the geometry that was most likely 7 provided to you by 3M; correct? 8 MR. GOSS: Lack of foundation, but you can 9 answer if you know. 10 A. I don't know if that is the geometry. 11 Q. Okay. But it's very similar; correct? 12 A. (Witness reviewing exhibit.) 13 MR. GOSS: You're on page 28? 14 MR. ASSAAD: Yes. 15 A. Yeah, it is -- 16 Yes. I would agree. 17 Q. Okay. And in fact the -- Never mind. 18 Do you agree that it seems like a study was 19 done by 3M that was memorialized in this memo on 20 October 15, 2015? 21 A. Yes. 22 Q. Okay. And they did schlieren testing at 3M. 23 MR. GOSS: Wait for a question. 24 Q. Correct? 25 MR. GOSS: Objection, lack of foundation.</p>
<p style="text-align: right;">Page 303</p> <p>1 trial testimony; correct? 2 A. Correct. 3 Q. Now -- 4 MR. ASSAAD: Let's mark this. 5 (Abraham Exhibit 9 marked for 6 identification.) 7 BY MR. ASSAAD: 8 Q. Exhibit 9 is a document titled -- with the 9 Bates number Wagner 0000013. Have you received this 10 document before? 11 A. Yes. 12 Q. Okay. And this was authored by Andrew Chen, 13 correct? If you look at the bottom left-hand corner? 14 A. Yes. 15 Q. Okay. And is this the document where -- in 16 which you obtained your initial boundary conditions 17 with respect to mass flow? 18 A. "Initial" and "boundary conditions" don't go 19 together. 20 Q. I'm sorry. Your boundary conditions. 21 A. This is the document which confirmed my 22 understanding of the boundary condition for the Bair 23 Hugger. So I would say it confirmed my boundary 24 conditions. 25 Q. Okay. And if you look at pages 23, 24, 25</p>	<p style="text-align: right;">Page 305</p> <p>1 MR. ASSAAD: I'll withdraw that ques -- 2 Q. Do you agree that this model contains 3 schlieren photography? 4 MR. GOSS: The memo. 5 MR. ASSAAD: Yes. 6 MR. GOSS: You said "model." 7 MR. ASSAAD: Huh? 8 MR. GOSS: Sorry. You said "model." You 9 meant "memo." 10 A. Yes. 11 Q. Okay. And if you look at page Wagner 19, 12 you agree with me that the bottom image shows a 13 schlieren photography of air from a rolled-up Bair 14 Hugger blanket; correct? Figure 8. 15 (Interruption by the reporter.) 16 A. What's your question again? 17 Q. According to Figure 8 it's a schlieren 18 picture of air emitted from the end of a rolled-up 19 Bair Hugger blanket; correct? 20 A. That's what this figure shows. 21 Q. Okay. And you have no reason to disagree 22 with that; correct? 23 A. Correct. 24 Q. Okay. And in fact the schlieren mirror is 25 26 inches in length; correct?</p>

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<p style="text-align: right;">Page 306</p> <p>1 MR. GOSS: Object to the lack of 2 foundation. If that's what the document shows, you 3 can testify to that. 4 A. 26 inches is stated in the document. 5 Q. Okay. Let's look at Figure 9 on the 6 following page, Wagner 20. Figure 9 says, "Air 7 departing the region around the blanket representing 8 the neck region of the blanket." Do you see that? 9 A. Yes. 10 Q. And you see a schlieren photography and 11 something there that says 6 inches; correct? 12 A. Yes. 13 Q. Okay. So you would agree with me that the 14 -- the disruption or the -- the refractiveness of the 15 -- the light or the imaging, which is what schlieren 16 shows -- 17 You understand that; correct? 18 A. Yes. 19 Q. -- is when the air is coming out of the neck 20 region of the blanket it's a little over 6 inches; 21 correct? 22 MR. GOSS: Object to the lack of 23 foundation, lack of expertise in schlieren imaging. 24 You can testify to what the document shows if you 25 understand it.</p>	<p style="text-align: right;">Page 308</p> <p>1 Q. Okay. If you look at page Wagner 14, under 2 "Bair Hugger Product Testing" it states: Testing the 3 Bair Hugger product for volumetric flow was necessary 4 to determine the boundary condition for a CFD model of 5 a blanket with an actual operating room. 6 Did I read that correctly? 7 A. Yes. 8 Q. So you agree with me that they did product 9 testing to determine the -- a boundary condition for 10 the -- for a CFD model; correct? 11 A. Yes. 12 Q. And it says: A mass flowrate inlet 13 condition was used in the operating room CFD model as 14 the operating room supply air inlet boundary condition 15 as well as the Bair Hugger air inlet using faces at 16 the inlet boundary. 17 Did I read that correctly? 18 A. With the exception of you said "at," I 19 think, or -- yeah -- yes, you read that correctly. 20 MR. GOSS: I'm just going to insert an 21 objection that 3M may have done some testing 22 internally for attorney-client purposes, we would 23 assert work-product protection over that and reserve 24 the right to claw back any portions of this memo that 25 relate to that and do not have any relevance to Dr.</p>
<p style="text-align: right;">Page 307</p> <p>1 A. Can you restate your question? 2 Q. Let me ask. Do you -- 3 Have you ever used schlieren photography 4 before? 5 A. No. 6 Q. Okay. Do you understand schlieren 7 photography? 8 A. I understand the basics of it. 9 Q. Okay. So the fact that if you look at the 10 -- the -- Strike that. 11 Now with respect to -- Let's go to page 15. 12 Figure 2 says a "System of Bair Hugger Model 750 13 blower and Upper Body Model 522 blanket integrated 14 with flow measurement system pitot tube in a flow 15 development pipe and" -- 16 (Interruption by the reporter.) 17 Q. -- with flow measurement system pitot tube, 18 P-I-T-O-T, in a flow development pipe and "Magnehlic 19 manometer." 20 A. It's "Magnehlic," but yes. 21 Q. Okay. And in fact if you look, you agree 22 with me that 3M did testing to determine the initial 23 conditions to be used in a CFD analysis. 24 A. I'm not clear in this document where it says 25 that.</p>	<p style="text-align: right;">Page 309</p> <p>1 Abraham's work or his use of the document. 2 MR. ASSAAD: Okay. 3 Q. So it states here under the last paragraph: 4 "For the Upper Body (Model 522) with one side rolled 5 up," -- And that's the case that you used in your CFD 6 modeling; correct? 7 A. Correct. 8 Q. Okay. 9 -- "a mass flow rate of 0.237 kilograms per 10 second was calculated and used as an inlet condition 11 for the area around the arms in the OR CFD model." 12 Did I read that correctly? 13 A. Yes. 14 Q. You did not have an inlet condition around 15 the arms of an OR CFD model; correct? 16 A. Correct. 17 Q. Okay. For a fully open blanket and draping 18 arrangement, 0.0255 kilograms per second, open 19 parentheses, half on arms and half on the other side 20 of the -- of head, closed parentheses, was used in the 21 second OR CFD model as a Bair Hugger inlet condition. 22 Did I read that correctly? 23 A. Yes. 24 Q. So according to what 3M did, it's my 25 understanding that based on the Bair Hugger product</p>

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<p style="text-align: right;">Page 310</p> <p>1 testing that when the Bair Hugger is folded over, the 2 mass flow rate of .0237 kilograms per second was going 3 over the arms; correct? 4 MR. GOSS: I will object again that any 5 internal testing -- 6 MR. ASSAAD: I got your objection. 7 MR. GOSS: -- described in this document -- 8 MR. ASSAAD: Don't waste my time, please. 9 Stop the clock, then. I don't want to waste my time. 10 I got your objection, it's already been said, we 11 don't need to reiterate the record. 12 MR. GOSS: And this witness has no 13 foundation. I think he's already said he has no 14 foundation with respect to any internal CFD testing 15 that 3M did. 16 Q. Go on. 17 Did I read that correctly? 18 A. I don't recall what you read, actually. 19 Q. The question was: Do you agree with me that 20 according to what 3M's product testing did, when the 21 Bair Hugger blanket is folded over, similar to what 22 you did in your CFD, that they calculated that there 23 is a mass flow over -- or on the area around the arms 24 and that was used in the OR CFD model; correct? 25 A. That is what it says.</p>	<p style="text-align: right;">Page 312</p> <p>1 A. Correct. 2 Q. And you're basing it off the experiments 3 that 3M did which is marked as Exhibit Number 9; 4 correct? 5 MR. GOSS: Object to form, mischaracterizes 6 his testimony. He has already answered this. 7 If you have a different answer, you may 8 offer it. 9 A. My flow rate was based on my own experience 10 of years working with these types of blankets. As -- 11 As I said earlier -- As I said earlier in this 12 deposition, this -- these results confirmed my 13 knowledge of the airflow. 14 Q. I mean, we're talking about a flow rate 15 going out to three decimal places. Correct? Am I 16 correct? Three decimal places; correct? 17 A. Two significant figures. 18 Q. Okay. But three decimal places; correct? 19 "Two significant figures." You want to use two -- 20 That's fine. 21 Two significant figures of a difference of 22 .002; correct? 23 A. Are you talking about the 3M document or my 24 document? Because the 3M document uses different 25 numbers. I actually didn't use their numbers.</p>
<p style="text-align: right;">Page 311</p> <p>1 MR. GOSS: Same objection. 2 Q. Okay. And when the blanket was open, that 3 based on testing they calculated a mass flow of .0255 4 kilograms per second, which was half on the arms and 5 half on the other side of the head; correct? 6 A. That's what the document says. 7 Q. And in fact you used this document, sir, if 8 you look at page 5 of your report where you took the 9 measurements from this document and applied it in your 10 report. Right above where it says "Step 5." 11 MR. GOSS: You can -- 12 Q. I'll read it to you. Page 5, above where it 13 says "Step 5 of the Analysis..." "Measurements were 14 made using a Bair Hugger Blower model 750 and an Upper 15 Body Blanket Model 522 to determine the flowrate 16 through the system. The experiments" -- I'd like to 17 say that word again, "experiments" -- 18 MR. GOSS: Okay. 19 Q. -- "found a flow rate" -- 20 MR. GOSS: You don't have to make faces at 21 me, Gabriel. 22 Q. -- of .023 kilograms per second for a 23 partially obstructed blanket and .025 kilograms per 24 second for a fully open blanket." 25 Is that correct?</p>	<p style="text-align: right;">Page 313</p> <p>1 Q. For the flow rate of a Bair Hugger blanket 2 which is folded, you have -- or partially 3 obstructed -- Would you say that's equivalent to being 4 folded? 5 A. Yes. 6 Q. -- you have .023, and in the Bair Hugger 7 testing they have 0.237; correct? 8 A. Correct. 9 Q. Okay. And for a open blanket you have .025 10 and they have .0255; correct? 11 A. That is correct. 12 Q. Okay. So you're telling me that based on 13 your experience with forced-air warming blankets that 14 you predicted these numbers that were that similar to 15 3M? Is that what you're saying here today, sir? 16 MR. GOSS: There's no -- You asked him the 17 question, there's no need for you to raise your 18 voice, and I will -- 19 Q. Well there's nothing in these papers -- 20 MR. GOSS: -- and I will try to keep mine 21 down, too. 22 Q. There's nothing in the papers to answer that 23 question. So I'm saying because this is off of your 24 memory that you got these numbers; correct? 25 A. No. That's not what I'm saying.</p>

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<p style="text-align: right;">Page 314</p> <p>1 Q. So where'd you get your numbers from?</p> <p>2 A. In fact I didn't use their numbers. These</p> <p>3 numbers are different.</p> <p>4 What I'm saying, I've done many experiments</p> <p>5 on Bair Hugger and similar blankets. My recollection</p> <p>6 was that the -- the -- I recalled the flow rate</p> <p>7 through the Bair Hugger, it was very close, not the</p> <p>8 same as the Technical Data Sheet that we've got here,</p> <p>9 that confirmed that my answers -- my recollection was</p> <p>10 correct. But you notice I didn't take their numbers.</p> <p>11 I did not use their numbers as inputs.</p> <p>12 Q. You just took it out to two significant</p> <p>13 places.</p> <p>14 A. Well had I used their numbers, I -- and had</p> <p>15 I rounded, I would have had .024, and I have .023.</p> <p>16 They're close, but they're not the same. I did not</p> <p>17 solely rely on this. This confirmed my understanding.</p> <p>18 Q. Where are the calculations or the documents</p> <p>19 that you got your numbers from?</p> <p>20 A. It's from past work that I've done on Bair</p> <p>21 Huggers.</p> <p>22 Q. Okay. So you have done work on a Bair</p> <p>23 Hugger 750 blower and a 522 blanket.</p> <p>24 A. I didn't say that.</p> <p>25 Q. Do you agree with me that every blanket will</p>	<p style="text-align: right;">Page 316</p> <p>1 And based -- If you look at the last page of</p> <p>2 this document, you agree with me that they used -- if</p> <p>3 you look at the second-to-last sentence, they used</p> <p>4 Star CCM+ as the commercial CFD code.</p> <p>5 MR. GOSS: Objection, lack of foundation.</p> <p>6 You can testify as to whether he read that</p> <p>7 correctly.</p> <p>8 A. It says here: "In all scenarios Star CCM+,</p> <p>9 (a commercial CFD code) was used to model the air</p> <p>10 flows."</p> <p>11 Q. I'm sorry. I missed what you said.</p> <p>12 A. I read the sentence. I confirmed what the</p> <p>13 sentence said.</p> <p>14 Q. Okay. And they actually used a polyhedral</p> <p>15 mesh of 12 million and some cells; correct?</p> <p>16 A. That is --</p> <p>17 MR. GOSS: Again, lack of foundation, and</p> <p>18 I'm going to actually stop any more questions about</p> <p>19 the CFD which was done internally which again we are</p> <p>20 asserting work-product protection over. He has not</p> <p>21 testified that he has seen any of it or relied on</p> <p>22 any -- any CFD imaging that may have been done</p> <p>23 internally by 3M.</p> <p>24 MR. ASSAAD: Well first of all, you</p> <p>25 referenced this document early on in this deposition</p>
<p style="text-align: right;">Page 315</p> <p>1 have a different mass flow rate because of the</p> <p>2 resistance to the motor?</p> <p>3 A. That is correct.</p> <p>4 Q. Okay. And you agree with me that the 750</p> <p>5 has a different volumetric flow without a blanket than</p> <p>6 the 505 or the Smiths Medical or any other non-750</p> <p>7 blower out there.</p> <p>8 A. I agree --</p> <p>9 Q. Okay.</p> <p>10 A. -- that blowers have a different flow rate.</p> <p>11 Q. So sitting here today you're going to</p> <p>12 testify to a jury in Minnesota that you've obtained</p> <p>13 these very similar numbers to the Bair Hugger</p> <p>14 experiments that -- of Exhibit 9 based on your memory</p> <p>15 and experience of working with different forced-air</p> <p>16 warming devices.</p> <p>17 A. What I can tell you is I had the number in</p> <p>18 my mind of what the flow rate through these systems</p> <p>19 were. I used this -- [Exhibit 9] I received this</p> <p>20 datasheet and it verified, hey, this is very close,</p> <p>21 and so I used my numbers.</p> <p>22 Q. But your -- you can't reproduce your numbers</p> <p>23 from some physical document or even notes.</p> <p>24 A. That is correct. I cannot.</p> <p>25 Q. Okay. And in fact -- Strike that.</p>	<p style="text-align: right;">Page 317</p> <p>1 about a document produced by Jennifer Wagner;</p> <p>2 correct? And this was --</p> <p>3 MR. GOSS: I'm not being deposed, Gabriel.</p> <p>4 You can ask him the question.</p> <p>5 MR. ASSAAD: Well we've had the records</p> <p>6 indicate it, and you've had this document -- you</p> <p>7 provided this document way back in January and now</p> <p>8 you're claiming attorney work product?</p> <p>9 MR. GOSS: You've had this document a long</p> <p>10 time. I'm saying that the references to CFD that</p> <p>11 were done internally, that is attorney work product</p> <p>12 and we reserve the right to claw it back.</p> <p>13 And you can ask him about what he</p> <p>14 considered from this document with respect to his</p> <p>15 opinions, but other than that I'm going to instruct</p> <p>16 him not to speculate about anything in here that he</p> <p>17 doesn't know anything about.</p> <p>18 BY MR. ASSAAD:</p> <p>19 Q. You understand CFD modeling; correct?</p> <p>20 A. Yes.</p> <p>21 Q. Okay. You understand that if you look at</p> <p>22 here they used a RANS model, item number 7; correct?</p> <p>23 MR. GOSS: I'm going to instruct you not to</p> <p>24 answer anything based on lack of foundation and no</p> <p>25 relevance to your opinions in this case.</p>

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<p style="text-align: right;">Page 318</p> <p>1 Q. Correct?</p> <p>2 MR. ASSAAD: Are you instructing him not to</p> <p>3 answer?</p> <p>4 MR. GOSS: Right.</p> <p>5 MR. ASSAAD: Okay.</p> <p>6 Q. You agree with me that 3M used an ideal gas</p> <p>7 and did not use the Boussinesq according to their --</p> <p>8 their -- the air physics that were followed; correct?</p> <p>9 MR. GOSS: Is that something that you</p> <p>10 considered for your opinions in this case?</p> <p>11 THE WITNESS: No.</p> <p>12 MR. GOSS: Then I instruct you not to</p> <p>13 answer.</p> <p>14 Q. Okay. You agree with me that they used a</p> <p>15 K-epsilon two-layer buoyancy driven XU option;</p> <p>16 correct?</p> <p>17 MR. GOSS: Is that something that you</p> <p>18 considered for your work in this case?</p> <p>19 THE WITNESS: No.</p> <p>20 MR. GOSS: Then I instruct you not to</p> <p>21 answer.</p> <p>22 Q. This document was provided to you; correct?</p> <p>23 A. Correct.</p> <p>24 Q. You received this document previously;</p> <p>25 correct?</p>	<p style="text-align: right;">Page 320</p> <p>1 Q. Well it's dated October 15th, 2015; correct?</p> <p>2 A. Yes.</p> <p>3 Q. Okay. And you said you compared your</p> <p>4 numbers to the numbers that were in this document</p> <p>5 regarding mass flow; correct?</p> <p>6 A. What I said was that --</p> <p>7 Q. Let me rephrase. Your numbers --</p> <p>8 Your memory and your experience confir --</p> <p>9 was confirmed by the numbers in this document.</p> <p>10 A. My memory was confirmed by the flow numbers</p> <p>11 in Table 1 of this document.</p> <p>12 MR. ASSAAD: Let's take a break.</p> <p>13 THE REPORTER: Off the record, please.</p> <p>14 (Recess taken from 5:50 to 5:58 p.m.)</p> <p>15 BY MR. ASSAAD:</p> <p>16 Q. I'd like to turn to page 5 of your report.</p> <p>17 Are you there? I want to talk about validation, the</p> <p>18 validated method; correct? That's what step 5 is;</p> <p>19 correct?</p> <p>20 A. Yes.</p> <p>21 Q. Okay. It states here that you took</p> <p>22 measurements of the room and you find it -- you found</p> <p>23 it to be 61 degrees Fahrenheit during the procedure;</p> <p>24 is that correct?</p> <p>25 A. Correct.</p>
<p style="text-align: right;">Page 319</p> <p>1 MR. GOSS: That's been well established,</p> <p>2 but --</p> <p>3 MR. ASSAAD: I'm asking him.</p> <p>4 MR. GOSS: -- you can answer again.</p> <p>5 MR. ASSAAD: Let me set up my case for the</p> <p>6 motion.</p> <p>7 A. Yes.</p> <p>8 Q. Okay. And actually, Jennifer Wagner, who</p> <p>9 assisted you in this case in some of the -- when you</p> <p>10 went to the OR, has also been provided a copy of this</p> <p>11 document.</p> <p>12 A. I don't know if that's true.</p> <p>13 Q. Okay. Well the fact that it says "Wagner</p> <p>14 0000013," I represent to you that she's the one that</p> <p>15 produced this document.</p> <p>16 MR. GOSS: You can wait for a question.</p> <p>17 Q. And you reviewed this document and</p> <p>18 considered it with respect to your opinions; correct?</p> <p>19 MR. GOSS: You can testify to what you</p> <p>20 considered out of this document with respect to your</p> <p>21 opinions.</p> <p>22 Q. You were provided this document before you</p> <p>23 did your CFD analysis.</p> <p>24 A. I don't know the answer to that. I don't</p> <p>25 know if I was.</p>	<p style="text-align: right;">Page 321</p> <p>1 Q. Where'd you take the measurements?</p> <p>2 A. Multiple locations.</p> <p>3 Q. Where?</p> <p>4 A. All -- I walked all the way around the</p> <p>5 perimeter of the OR table multiple times and I took</p> <p>6 measurements at different heights.</p> <p>7 Q. You agree the image that we put up regarding</p> <p>8 the temperature differences in the room, that many of</p> <p>9 the temperatures around the OR table were less than 61</p> <p>10 degrees; correct?</p> <p>11 A. Some temperatures were slightly less than</p> <p>12 61.</p> <p>13 Q. Okay. And by the way, do you believe that</p> <p>14 your CFD showed -- only has 8.1 million cells?</p> <p>15 A. I believe that's true.</p> <p>16 Q. If the CFD showed that there was over 9</p> <p>17 million, would you disagree with that, the TRN file?</p> <p>18 A. No.</p> <p>19 Q. Okay. So this would be incorrect about 8.1</p> <p>20 million cells then; correct? That you've testified</p> <p>21 earlier and that's in your validation.</p> <p>22 A. Well would -- if -- if my TRN file shows</p> <p>23 that I have 9 million cells, it means that, if</p> <p>24 anything, it's more accurate.</p> <p>25 Q. It just means that there's more cells. It</p>

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<p style="text-align: right;">Page 322</p> <p>1 doesn't mean it's more accurate unless you do a 2 quasi-steady solution judgment; correct? 3 A. That -- 4 Q. I mean more cells don't mean it's more 5 accurate; correct? 6 A. That's not true. Most -- More cells, in 7 almost every case, means more accurate. And in fact 8 Elghobashi agreed with that. 9 Q. Well if you have -- 10 You did 60 million cells. Are you telling 11 me the 60-million-cell solution is more accurate than 12 the one provided in your report? 13 A. Adding more cells always has the potential 14 to make your results more accurate. 15 Q. "Potential." 16 A. That's right. 17 Q. It doesn't mean it's more accurate. You 18 might get the same solution whether you have 60 19 million cells or 5 million cells. 20 A. Yes, you're right. 21 Q. Okay. So the -- So that statement is 22 incorrect that the more cells automatically means it's 23 more accurate. It may be more accurate, but it might 24 not be. 25 A. Correct. And I don't think I used the word</p>	<p style="text-align: right;">Page 324</p> <p>1 that I could get an average temperature that -- that 2 -- I mean there's obviously some short-term time-wise 3 fluctuations. This -- This number represents enough 4 measurements that I got a steady temperature variable. 5 Q. But you can't tell me how many; can you? 6 Sitting here today. 7 A. Correct. 8 Q. And you have no notes to indicate actual -- 9 the numbers that you took down or the measurements; 10 correct? 11 A. Well the numbers that I took down are the 12 numbers that we see here. 13 Q. But to do an average you have multiple 14 numbers; correct? 15 A. You can have the -- 16 And I don't know if I did this. You can 17 have the software do the averaging for you. And in 18 that case you wouldn't extract the individual numbers. 19 Q. Okay. But you need individual measurements 20 to have an average; correct? 21 A. That is correct. 22 Q. Okay. And either the software did it or you 23 did it to -- 24 A. Correct. 25 Q. Okay. And sitting here today we don't have</p>
<p style="text-align: right;">Page 323</p> <p>1 "automatically." 2 Q. Okay. So sitting here today I cannot 3 replicate where you took temperature measurements in 4 the room; correct? 5 A. I -- Well what you can -- 6 What this document says and what's implied 7 by this document is multiple temperature measurements 8 were made, and the average was 61 Fahrenheit. 9 Q. I understand that. But if I want to 10 replicate exactly what you did, I have no way of 11 knowing exactly where you took the measurements; 12 correct? 13 A. That is correct. 14 Q. Okay. And also you took measurements three 15 inches off the floor and you measured that to be 60 16 degrees Fahrenheit; correct? 17 A. That is correct. 18 Q. And where were those measurements taken? 19 A. Those measurements were directly underneath 20 the head. 21 Q. Okay. Was it one measurement or two 22 measurements, or three? 23 A. It would have been multiple measurements. 24 Q. Sitting here today, do you know how many? 25 A. It would have been enough measurements so</p>	<p style="text-align: right;">Page 325</p> <p>1 what those individual numbers are, and we will never 2 be able to find out what those individual numbers are 3 exactly; correct? 4 A. Based on this document what you would know 5 is that the temperature, the average temperature at 6 that location is 60 or 60.5. You would not have the 7 individual measurements that went into that number. 8 Q. So you agree with me. Sitting here today, I 9 cannot calculate what the average is based on 10 individual measurements because we do not have those 11 individual measurements; correct? 12 A. I disagree. 13 Q. How would I calculate an average unless I 14 have the numbers? 15 A. Well there are two sets of numbers here. 16 One of them is calculated, and that means from the CFD 17 model, so you could get that directly. 18 Q. But validation is based -- 19 Your validation is based on experimental 20 results; correct? 21 A. Yes. 22 Q. So if I want to test whether or not your 23 experiments indicate that the temperature three inches 24 above the floor -- the average temperature above the 25 floor was 60.5 degrees, I would need the individual</p>

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<p style="text-align: right;">Page 326</p> <p>1 numbers so I could calculate that average; correct?</p> <p>2 A. If you wondered whether I know how to do an</p> <p>3 average and you doubted that, then yes, you would need</p> <p>4 the individual numbers.</p> <p>5 Q. Okay. Because to calculate an average I</p> <p>6 need actual numbers to calculate an average from;</p> <p>7 correct?</p> <p>8 A. That is correct.</p> <p>9 Q. Okay. And that's not even college</p> <p>10 mathematics, that's like middle school maybe, or</p> <p>11 elementary? I don't know, but.</p> <p>12 MR. GOSS: That's my level mathematics.</p> <p>13 Q. So --</p> <p>14 And you agree with me that as an engineer --</p> <p>15 as -- it's good to, when you take measurements, to</p> <p>16 document them contemporaneously when you take the</p> <p>17 measurements; correct?</p> <p>18 A. If it's needed. If that documentation's</p> <p>19 necessary.</p> <p>20 Q. Or if you're writing a report -- an expert</p> <p>21 report in litigation and someone might want to</p> <p>22 reproduce how you calculated the average that would be</p> <p>23 something important to do; correct?</p> <p>24 A. Calculating the average is so trivial I</p> <p>25 wouldn't have even thought of doing that.</p>	<p style="text-align: right;">Page 328</p> <p>1 how things are done. So I understand you don't think</p> <p>2 it's necessary, but you never calculated those</p> <p>3 numbers; correct?</p> <p>4 A. Well I'm struggling to understa --</p> <p>5 Q. I'll withdraw that question.</p> <p>6 Did you ever talk to the manufacturer to see</p> <p>7 whether or not they recommended using this fog</p> <p>8 generator to determine whether or not it was a proper</p> <p>9 device to observe the airflow in an operating room?</p> <p>10 A. That was complex. Could you re-ask the</p> <p>11 question?</p> <p>12 Q. Did you talk to the manufacturer of this</p> <p>13 device, the fog generator, to determine whether or not</p> <p>14 this device would be a -- a device that could produce</p> <p>15 results that you could see in an operating room?</p> <p>16 A. No. It was not necessary.</p> <p>17 Q. Are you aware that the -- the person that</p> <p>18 provided the device to 3M stated that in turbulent or</p> <p>19 fast-moving air the fog generator would dissipate in</p> <p>20 two feet due to mixing?</p> <p>21 MR. GOSS: Object to form, lack of</p> <p>22 foundation.</p> <p>23 A. I've never heard the word "dissipate."</p> <p>24 Q. Or dissipate. I'm sorry.</p> <p>25 A. Could you read the sentence again?</p>
<p style="text-align: right;">Page 327</p> <p>1 Q. Okay. Now you also did -- you used a fog</p> <p>2 generator to do fog -- to do tests on the airflow;</p> <p>3 correct?</p> <p>4 A. Correct.</p> <p>5 Q. Okay. And the fog generator was provided by</p> <p>6 3M; correct?</p> <p>7 A. Correct.</p> <p>8 Q. Okay. Have you ever used a fog generator</p> <p>9 before?</p> <p>10 A. Yes.</p> <p>11 Q. Do you recall --</p> <p>12 Do you know how long the -- you'd be able to</p> <p>13 see the fog in a high velocity or turbulent flow?</p> <p>14 A. It depends.</p> <p>15 Q. Depends on what?</p> <p>16 A. Depends on the speed, depends on whether the</p> <p>17 flow is disbursing, so the patterns of airflow,</p> <p>18 depends on the level of turbulence.</p> <p>19 Q. And did you calculate or determine how long</p> <p>20 you would be able to see the fog in the test that you</p> <p>21 conducted?</p> <p>22 A. No. It was not necessary.</p> <p>23 Q. I understand that you believe it's not</p> <p>24 necessary. But sitting here today, if I want to</p> <p>25 replicate something I need to know all the facts and</p>	<p style="text-align: right;">Page 329</p> <p>1 Q. Are you aware that the person -- the company</p> <p>2 that provided the fog generator to 3M indicated to 3M</p> <p>3 that, in fast-moving air or turbulence it dissipates</p> <p>4 in a foot or two due to mixing with the air?</p> <p>5 MR. GOSS: Object -- Same objection.</p> <p>6 MS. ZIMMERMAN: Dissipates.</p> <p>7 Q. Dissipates.</p> <p>8 A. I'm not aware that they said that. I would</p> <p>9 say it begins to di -- that it dissipates all the</p> <p>10 time, but. So I don't know what the word "dissipates</p> <p>11 in two feet," I don't know what that phrase means.</p> <p>12 Q. Which means that in turbulent air you might</p> <p>13 not be able to see the fog because it dissipates in a</p> <p>14 foot or two -- a foot or two.</p> <p>15 MR. GOSS: Objection, lack of foundation</p> <p>16 with respect to this document, and misstatement.</p> <p>17 You can testify to it if you know the</p> <p>18 answer.</p> <p>19 (Abraham Exhibit 10 marked for</p> <p>20 identification.)</p> <p>21 BY MR. ASSAAD:</p> <p>22 Q. What's been marked as Exhibit 10 is Wagner</p> <p>23 0000001 that was produced in this case, and if you</p> <p>24 look, it's an email from Mr. Campbell from</p> <p>25 cleanroomfogger.com, or Clean Room Fogger, to Mr.</p>

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<p style="text-align: right;">Page 330</p> <p>1 Fowler at GT Law. Do you know Mr. Fowler?</p> <p>2 A. That name sounds familiar.</p> <p>3 Q. If you look at paragraph two, it states:</p> <p>4 "At the other end of the scale in fast moving air or</p> <p>5 turbulence it dissipates in a foot or 2 due to mixing</p> <p>6 with the air."</p> <p>7 Were you told that information regarding</p> <p>8 this fog generator that you used?</p> <p>9 A. I was not, and it wasn't relevant.</p> <p>10 Q. Okay. Well you saw the intensity model done</p> <p>11 by Dr. Elghobashi; correct? In his report.</p> <p>12 A. I recall turbulence intensity calculations.</p> <p>13 Q. Okay. If Elghobashi is correct in his</p> <p>14 report, you would agree with me that there is a --</p> <p>15 there is -- there's more than two feet distance</p> <p>16 between underneath the drape and the surgical site;</p> <p>17 correct?</p> <p>18 MR. GOSS: Object to form.</p> <p>19 A. I don't understand that question.</p> <p>20 Q. Well there's more than two feet of distance</p> <p>21 that air would have to travel between underneath the</p> <p>22 operating room table where the drape is, where the</p> <p>23 drape -- the end of the drape, and where the knee was</p> <p>24 in Dr. Elghobashi's model. You agree?</p> <p>25 A. Are you asking --</p>	<p style="text-align: right;">Page 332</p> <p>1 they're saying. So then the question is, does it?</p> <p>2 Does it adequately visualize airflow? And the fact</p> <p>3 is, it does, and we showed that in our operating room</p> <p>4 FloViz experiments.</p> <p>5 THE VIDEOGRAPHER: Ten minutes.</p> <p>6 Q. What test did you do to state that it would</p> <p>7 show -- it would have enough life in it, I guess, for</p> <p>8 lack of a better term, that you could see the fog</p> <p>9 within more than two feet in a turbulent flow in the</p> <p>10 operating room?</p> <p>11 A. Well first of all we have visual evidence.</p> <p>12 But secondly, the distance -- whether it can display</p> <p>13 fog in a visual manner for two feet or not is</p> <p>14 immaterial. What matters is does it display the fog</p> <p>15 long enough for long enough distances so that you can</p> <p>16 ascertain whether the Bair Hugger has an effect on</p> <p>17 flow. And it was --</p> <p>18 Q. And you would agree --</p> <p>19 MR. GOSS: Let him finish.</p> <p>20 MR. ASSAAD: I thought he was done.</p> <p>21 MR. GOSS: Thank you.</p> <p>22 THE WITNESS: Thank you.</p> <p>23 A. And this fog device, in my professional</p> <p>24 opinion, was able to show fog that extended long</p> <p>25 enough to provide that conclusion.</p>
<p style="text-align: right;">Page 331</p> <p>1 I think you're asking is the physical</p> <p>2 distance between the bottom of the drape in his model</p> <p>3 and a knee more than two feet.</p> <p>4 Q. Yes.</p> <p>5 A. Is that what you're asking?</p> <p>6 I believe it is more than two feet.</p> <p>7 Q. Okay. So if the fog generator dissipates</p> <p>8 within one or two feet according to what Mr. Campbell</p> <p>9 states in this email, it's possible that you could use</p> <p>10 the fog generator and you're not going to see anything</p> <p>11 occur two feet away from where you insert the fog in a</p> <p>12 turbulent -- in turbulence.</p> <p>13 MR. GOSS: Objection to form, calls for</p> <p>14 speculation.</p> <p>15 A. I disagree. This document, when I read this</p> <p>16 document I see the words "fast-moving air" or</p> <p>17 "turbulence." What that means is high turbulence.</p> <p>18 What this person is saying is, look, this may not be</p> <p>19 the right device to use in those situations. Okay?</p> <p>20 They talk in other places in the email about the fog</p> <p>21 lasting a long time. For example, they say in the</p> <p>22 very same paragraph: "A few feet from the filter it</p> <p>23 can last up to 10 feet." So what this person appears</p> <p>24 to be warning Mr. Fowler of is, this device may not</p> <p>25 provide good visualization of airflow. That's what</p>	<p style="text-align: right;">Page 333</p> <p>1 Q. But sitting here today you do not know how</p> <p>2 long the -- the fog generator will last in a -- in</p> <p>3 turbulence that may be found in an operating room.</p> <p>4 MR. GOSS: Object to form.</p> <p>5 A. No one can say that because there's -- I</p> <p>6 mean, what this -- what this person is doing is</p> <p>7 they're warning you. They're saying, look, this</p> <p>8 device, which they appear to be selling, sometimes has</p> <p>9 fog that lasts a long time and sometimes it doesn't,</p> <p>10 so if you have fast-moving air or turbulence you might</p> <p>11 want to be careful.</p> <p>12 Now the fact is we saw it last longer than</p> <p>13 two feet, and that tells me that we don't have much</p> <p>14 turbulence.</p> <p>15 Q. Did you take any measurements?</p> <p>16 A. Measure --</p> <p>17 Q. Did you take any measurements to say, look,</p> <p>18 we consider this lasting four feet or five feet?</p> <p>19 Visual measurements.</p> <p>20 A. There are visual measurements of how far it</p> <p>21 lasted in the videos.</p> <p>22 Q. With respect to --</p> <p>23 Are you familiar with the publication titled</p> <p>24 Resistive-Polymer Versus Forced-Air Warming:</p> <p>25 Comparable Efficiency in Orthopedic Patients, authored</p>

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<p style="text-align: right;">Page 334</p> <p>1 by Sebastian Brandt?</p> <p>2 A. I don't recall if I've read that one. It's</p> <p>3 possible, but I don't recall.</p> <p>4 Q. By the way, are you aware that every single</p> <p>5 study that looked at either particles or neutrally</p> <p>6 buoyant bubbles showed an increase in bubbles or</p> <p>7 particles over the surgical site when the Bair Hugger</p> <p>8 was on?</p> <p>9 MR. GOSS: Object to form.</p> <p>10 A. I don't know about "every single study."</p> <p>11 I'm aware of some that report to show that, and many</p> <p>12 of them I'm not impressed with. I believe that there</p> <p>13 are flaws in the papers.</p> <p>14 Q. What about the study that was funded and</p> <p>15 done by 3M?</p> <p>16 A. There was a study funded and done by 3M, and</p> <p>17 that study, if I recall correctly, had particle</p> <p>18 differences within the uncertainty of the</p> <p>19 observations, so essentially the same. And also if I</p> <p>20 recall -- and I'm doing this from memory, and I</p> <p>21 shouldn't be doing this -- but if I recall, when heat</p> <p>22 was turned on in some cases the particles went down.</p> <p>23 So -- And then finally, as I recall, every scenario</p> <p>24 that they looked at met the protective standard.</p> <p>25 Q. The protective effect.</p>	<p style="text-align: right;">Page 336</p> <p>1 with the same methodology, the same measurements,</p> <p>2 would that change your -- would that have an effect on</p> <p>3 your opinions in this case of whether or not the Bair</p> <p>4 Hugger had an effect on the unidirectional downward</p> <p>5 flow?</p> <p>6 MR. GOSS: Same objections as before.</p> <p>7 A. My recollection of that paper is that the</p> <p>8 results were within the uncertainty bounds, which</p> <p>9 means you could not say which scenario had more</p> <p>10 particles.</p> <p>11 My other recollection is that that study --</p> <p>12 Did that study ever test the composition of</p> <p>13 the particles? I -- I don't recall that they did.</p> <p>14 And I don't believe that that study had humans</p> <p>15 involved. So there's a number of questions that I</p> <p>16 would have about the study, I would need to see it.</p> <p>17 But what I recall is that they were -- the results</p> <p>18 were within uncertainty.</p> <p>19 Q. By the way, what do you mean by</p> <p>20 "significant"?</p> <p>21 A. It depends on the context.</p> <p>22 Q. So the term "significant" depends on the</p> <p>23 context with you?</p> <p>24 A. Yes. For instance, it could mean</p> <p>25 statistically significant, and it could mean</p>
<p style="text-align: right;">Page 335</p> <p>1 A. They may have called --</p> <p>2 Q. The DIN standard. The DIN standard.</p> <p>3 A. I believe they used the DIN standard, but I</p> <p>4 can't confirm.</p> <p>5 Q. Hypothetically speaking if you were to find</p> <p>6 out that the particles in the 3M-funded study</p> <p>7 increased by a hundred-fold, would that affect whether</p> <p>8 or not, in your opinion, the Bair Hugger had an effect</p> <p>9 on the downward flow -- the unidirectional downward</p> <p>10 flow?</p> <p>11 MR. GOSS: Object to form,</p> <p>12 incomplete/improper hypothetical, calls for</p> <p>13 speculation.</p> <p>14 A. I would need to see the study to assess its</p> <p>15 quality.</p> <p>16 Q. Well you've seen the study, correct, and you</p> <p>17 said it was within the margin of error.</p> <p>18 A. Wait. Are you talking about a hypo --</p> <p>19 Q. I'm talking about the --</p> <p>20 A. Oh.</p> <p>21 Q. I'm talking about the Sessler study.</p> <p>22 A. I'm sorry. I thought you were talking about</p> <p>23 a hypothetical study.</p> <p>24 Q. Well I'm saying if that same study indicated</p> <p>25 that the particle counts increased by a hundred times</p>	<p style="text-align: right;">Page 337</p> <p>1 qualitatively significant.</p> <p>2 Q. Your opinion in your conclusion says: "My</p> <p>3 opinion is that forced-air patient warming does not</p> <p>4 disrupt airflow in a way that would present a</p> <p>5 significant risk of infection."</p> <p>6 What do you mean by "significant" in that</p> <p>7 statement?</p> <p>8 A. I mean that in the --</p> <p>9 Oh, I was just waiting till you --</p> <p>10 Q. No. Go ahead.</p> <p>11 A. That statement does not refer to statistical</p> <p>12 significance. In that sense it means meaningful, or</p> <p>13 non-negligible.</p> <p>14 Q. Okay. It doesn't mean any clinical</p> <p>15 significance; correct?</p> <p>16 A. Correct.</p> <p>17 Q. Okay. It just means to you meaningful</p> <p>18 significance.</p> <p>19 A. That's right.</p> <p>20 Q. Okay. And what the is the basis for this</p> <p>21 opinion?</p> <p>22 A. I have a lot of opinions.</p> <p>23 Could you read this one again so you can</p> <p>24 refresh my memory? It's late in the day.</p> <p>25 Q. "My opinion is that forced-air patient</p>

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<p style="text-align: right;">Page 338</p> <p>1 warming does not disrupt airflow in a way that would 2 present a significant risk of infection." 3 A. It means what it says, that airflow from a 4 device like the Bair Hugger does not stop the downward 5 airflow from the ventilation system from washing over 6 the surgical site. 7 MR. GOSS: He asked for the basis of that. 8 THE WITNESS: Oh, the basis? 9 Q. Yeah. Is it your CFD study? 10 A. That would be one of the bases. 11 And I apologize for not listening carefully 12 to your question. 13 Q. Does the use of your term "significant" in 14 that context, in that opinion, mean you recognize 15 there may be some risk of infection? 16 A. No. 17 Q. Because you used the term "significant" 18 risk, not "any" risk. 19 A. Correct. I used that term. 20 Q. And you're not a neurobiologist; correct? 21 A. Correct. 22 Q. And you don't -- you don't hold yourself out 23 as an expert in microbiology; correct? 24 A. Correct. 25 Q. So sitting here today you don't know how</p>	<p style="text-align: right;">Page 340</p> <p>1 A. And I don't recall the in -- the question -- 2 the scientific question he was trying to ask. So 3 without looking at the paper I'm not prepared to say 4 it was a -- it's a flaw in his model or not. 5 Q. But if you didn't use drapes in your model, 6 that would be a flaw; correct? Because you want a 7 model as accurate as possible. 8 A. No. I've never said that. You need to 9 model the things that matter. 10 Q. Okay. 11 A. And some things matter. 12 So, for example, the anesthesia screen 13 matters. I mean, look, if I had the air oozing 14 vertically outwards without a drape I think that that 15 would matter, but that's not how I understand these 16 surgeries are done. 17 MR. ASSAAD: That's all I have. 18 MR. GOSS: All right. A couple questions 19 for you, Dr. Abraham. 20 Should we -- I guess should we trade 21 places, or does it matter? 22 (Discussion off the stenographic record.) 23 EXAMINATION 24 BY MR. GOSS: 25 Q. You brought some papers with you here today;</p>
<p style="text-align: right;">Page 339</p> <p>1 many bacteria or CFUs could cause a -- could be a 2 significant risk of infection to a person that's 3 having an implant surgery; correct? 4 A. That is correct. 5 Q. Okay. And -- Does the fact that Memarzadeh, 6 that showed a slight disruption in laminar flow using 7 the 505, did not use the 750 in his study and that 8 might show a more increased disruption of laminar 9 flow? If you recall? 10 A. Is this the Memarzadeh study where he had 11 the air jets just emerging from the top of the 12 patient? 13 Q. Yeah. 14 A. So there was no draping on it? 15 Q. Yes. 16 A. Boy, that's so different from this case. 17 Q. I think we can agree on something. 18 That's a flaw by not having the patient 19 being draped because the drape would affect airflow; 20 correct? 21 A. If your model -- 22 So he may have been modeling a different 23 surgery. I don't -- I don't recall what he was 24 modeling. 25 Q. Okay.</p>	<p style="text-align: right;">Page 341</p> <p>1 correct, Dr. Abraham? 2 A. That is correct. 3 Q. All right. And within that group there were 4 a couple of publications by Apte. You recall those? 5 A. Yes. 6 Q. All right. And you can refer to them if you 7 need to. 8 Why did you bring those papers? 9 A. It's my understanding that Apte is the 10 person who actually did the calculations, or perhaps 11 more accurate to say his graduate students. It's my 12 understanding Dr. Elghobashi did not do the 13 calculations himself. It's my understanding, based on 14 sitting in the deposition, that it wasn't Elghobashi's 15 software. 16 It is clear from Elghobashi's report that he 17 relied upon the Apte work and he relied upon citations 18 to Apte's code that reportedly showed validation. And 19 I would argue that when you look at these papers cited 20 by Elghobashi, they do not show validation. 21 Q. Why not? 22 A. Validation is best demonstrated by comparing 23 your results against an experiment. That's the 24 classic form of validation. And I can look at -- I am 25 citing Apte, Mahesh, Gorokhovski and Moin, 2009. And</p>

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<p style="text-align: right;">Page 342</p> <p>1 I believe this was cited in the Elghobashi report as 2 validation. In Figure 4 there's a comparison of 3 simulations to experiments, and there is an "a" and a 4 "b" part. And what we see is that there is a 5 experimental error bar which is listed in the caption, 6 and in some cases the simulation is outside of the 7 error bar. 8 Q. By how much? 9 A. Well in -- in Figure 4 a it's hard to 10 determine, maybe a hundred percent in some cases. But 11 then there's Figure 5, the very next figure, and the 12 caption says, "Comparison of normalized droplet 13 mass-distribution at different axial locations." By 14 the way, that's particle tracking. And there are 15 experiments, and then there is the so-called LES 16 calculation which I understand Elghobashi used in this 17 case. And the errors there are approximately 400 18 percent. 19 There was another Moin and Apte paper which 20 shows the same experimental work. So this isn't just 21 in one paper, it's in multiple ones. 22 Q. Is that paper cited by Dr. Elghobashi? 23 A. Yes, it is. And it is Moin and Apte 2006. 24 And what's interesting about this second paper is we 25 see something very interesting about the software.</p>	<p style="text-align: right;">Page 344</p> <p>1 Experiment Setup" from the Belani paper it says: 2 Bubbles were introduced at the head and neck of the 3 mannequin to track under drape resident air movements 4 in the region where...excess patient warming heat was 5 being released." In -- 6 Q. Why is that statement significant to you? 7 A. Well, it agrees with where I had the Bair 8 Hugger air enter the room. And in fact that's 9 confirmed by the other paper, which is McGovern. 10 Now they're working on hip replacement. So 11 this is knee and hip. And they say -- I've got to 12 find it. Ahh. Bubbles were introduced at the floor 13 level between the surgeon's body and the operating ta 14 -- Let's see. Hold on. That may not be the right 15 one. I have to find it. Oh, here. 16 I'm in the section called "Experimental 17 Setup: Hip Replacement." Bubbles were introduced at 18 the head and neck region of the mannequin to track 19 under-drape resident air movements in the region where 20 the excess heat from the patient warming was being 21 released. 22 So the documents relied upon by the 23 plaintiffs agree with my supposition of where the heat 24 enters the room. 25 MR. ASSAAD: I have a couple follow-up, if</p>
<p style="text-align: right;">Page 343</p> <p>1 Dr. Elghobashi mentioned in his deposition, once you 2 validate for one case that's more complex and has all 3 the ingredients, he said, you don't need to revalidate 4 it. And I would argue strongly against that. 5 This is a case, it's a simulation that 6 appears to be performed over a few centimeters' fluid 7 domain, so a very small object, and the simulations 8 were carried out to three milliseconds, and we see 9 that in Figure 6. 10 It's my understanding that these papers do 11 not, do not have buoyancy. So to say that a very 12 small, very short-term simulation which is not well 13 compared with experiments provides validation is, in 14 my mind, an error. 15 I brought two other papers. 16 Q. What are those papers about? 17 A. These are papers that have been referenced 18 in the course of this litigation. One is Belani, the 19 year is 2012. And another one is McGovern, et al., 20 year 2011. 21 Q. Why did you bring those papers? 22 THE VIDEOGRAPHER: Two minutes left on the 23 tape. 24 THE WITNESS: This'll be fast. 25 A. In a section called "Total Knee Replacement</p>	<p style="text-align: right;">Page 345</p> <p>1 you're not done. 2 MR. GOSS: Okay. So we better change the 3 tape. 4 (Recess taken from 6:28 to 6:30 p.m.) 5 (Abraham Exhibits 11 - 14 marked 6 for identification.) 7 BY MR. GOSS: 8 Q. All right, Dr. Abraham. Showing you Exhibit 9 11, "Stochastic modeling of atomizing spray in a 10 complex swirl injector using large eddy simulation." 11 Is that one of the Apte papers that you were 12 discussing earlier? 13 A. Yes, it is. 14 Q. Okay. And this is one of the papers that 15 was referred to -- or was this one of the papers 16 referred to by Dr. Elghobashi as validating his CFD? 17 A. Yes. 18 Q. In your opinion, does it validate his CFD? 19 A. No. 20 Q. Exhibit 12 is a reference "Large-Eddy 21 Simulation of Realistic Gas Turbine Combustors," by 22 Moin and Apte. Is that an article or publication 23 cited by Dr. Elghobashi as validation of his CFD? 24 A. Yes, it is. 25 Q. In your opinion does that validate his CFD?</p>

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<p style="text-align: right;">Page 346</p> <p>1 A. It does not.</p> <p>2 Q. Exhibit 13 is McGovern, et al. "Forced-air</p> <p>3 warming and ultra-clean ventilation do not mix."</p> <p>4 And this is the paper from which you were</p> <p>5 reading about the -- the location of the helium --</p> <p>6 neutrally buoyant helium bubbles being released around</p> <p>7 the head and neck of the mannequin; is that correct?</p> <p>8 A. Yes.</p> <p>9 Q. All right. And finally, Exhibit 14 is</p> <p>10 Belani, et al., "Patient Warming Excess Heat: The</p> <p>11 Effects of Orthopedic Operating Room Ventilation</p> <p>12 Performance," and is that another paper where the</p> <p>13 experiment released the flow tracer from the head and</p> <p>14 neck area of a mannequin?</p> <p>15 A. Yes, it is.</p> <p>16 Q. And in that paper there was a statement that</p> <p>17 -- that that is where the excess heat from the Bair</p> <p>18 Hugger was released; is that correct?</p> <p>19 A. Correct.</p> <p>20 Q. You attended Dr. Elghobashi's deposition;</p> <p>21 correct?</p> <p>22 A. Correct.</p> <p>23 Q. And that was after you submitted your report</p> <p>24 in this case on January -- I'm sorry -- June 2nd;</p> <p>25 correct?</p>	<p style="text-align: right;">Page 348</p> <p>1 Q. Okay. And are you prepared to offer</p> <p>2 opinions at trial with respect to that analysis?</p> <p>3 A. Yes, I am.</p> <p>4 Q. What errors specifically did you identify in</p> <p>5 -- in that Exhibit B to the errata sheet?</p> <p>6 A. Do you have it? Could I look at it?</p> <p>7 Q. Yes.</p> <p>8 A. Or I could do it by memory.</p> <p>9 MR. ASSAAD: Just for the record, I'm going</p> <p>10 to need at least another half -- you're bringing up</p> <p>11 new issues that are not raised in his report, stuff</p> <p>12 that's not cited in his report, and if we're going</p> <p>13 along this path of new opinions I'm going to request</p> <p>14 another 30 minutes to an hour to go over these</p> <p>15 documents that I haven't had a chance to go over till</p> <p>16 today, or his opinions.</p> <p>17 MR. GOSS: Well it's his errata sheet.</p> <p>18 It's --</p> <p>19 MR. ASSAAD: And he did not --</p> <p>20 MR. GOSS: -- Dr. Elghobashi's errata</p> <p>21 sheet.</p> <p>22 MR. ASSAAD: He did not cite any of these</p> <p>23 documents or any of this rebuttal opinions in his</p> <p>24 report.</p> <p>25 MR. GOSS: Well of course he didn't. This</p>
<p style="text-align: right;">Page 347</p> <p>1 A. Correct.</p> <p>2 Q. Did you form opinions as a result of --</p> <p>3 Well first of all, let me ask you: Why did</p> <p>4 you attend Dr. Elghobashi's deposition?</p> <p>5 A. His report was not written in a clear way</p> <p>6 and I had questions about how his analysis was done.</p> <p>7 Q. And what did you learn from that analysis?</p> <p>8 A. I learned that my initial critiques still</p> <p>9 held, and in fact I -- are strengthened.</p> <p>10 Q. Okay.</p> <p>11 (Interruption by the reporter.)</p> <p>12 Q. And are you prepared to offer opinions at</p> <p>13 trial based on the information you obtained during Dr.</p> <p>14 Elghobashi's deposition?</p> <p>15 A. Yes, I am.</p> <p>16 Q. Now yesterday you saw a document from Dr.</p> <p>17 Elghobashi called Exhibit B to his errata sheet. Do</p> <p>18 you recall that?</p> <p>19 A. Yes.</p> <p>20 Q. Did you have an opportunity to review that?</p> <p>21 A. Yes.</p> <p>22 Q. And are you prepared to offer --</p> <p>23 Well first of all, what did you determine</p> <p>24 from your review of that document?</p> <p>25 A. His analysis is in error.</p>	<p style="text-align: right;">Page 349</p> <p>1 all happened after the report.</p> <p>2 MR. ASSAAD: He's had those documents that</p> <p>3 were cited by Abraham -- or by Elghobashi prior to</p> <p>4 the deposition and prior to the submission of his</p> <p>5 report. He did not put any of those critiques</p> <p>6 regarding Apte's papers --</p> <p>7 MR. GOSS: We can go as long as you need.</p> <p>8 MR. ASSAAD: Okay.</p> <p>9 MR. GOSS: That's fine.</p> <p>10 MR. ASSAAD: Fair enough.</p> <p>11 MR. GOSS: All right. I need to take a</p> <p>12 break to copy this real quick.</p> <p>13 THE REPORTER: Off the record, please.</p> <p>14 (Recess taken from 6:37 to 6:39 p.m.)</p> <p>15 (Abraham Exhibit 15 marked for</p> <p>16 identification.)</p> <p>17 BY MR. GOSS:</p> <p>18 Q. All right. So Exhibit 15 is, I will</p> <p>19 represent to you, even though it doesn't say "Exhibit</p> <p>20 B" on top of it, this is a copy of Exhibit B to Dr.</p> <p>21 Elghobashi's errata sheet.</p> <p>22 MR. GOSS: I will say for the record that</p> <p>23 we consider it to be an improper submission,</p> <p>24 nevertheless, since Dr. Abraham is here and has</p> <p>25 reviewed it, I will present it to him and ask him to</p>

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<p style="text-align: right;">Page 350</p> <p>1 testify as to --</p> <p>2 Q. Well, let me just ask you:</p> <p>3 What errors did you identify in this Exhibit</p> <p>4 B? Or Exhibit 15. Sorry.</p> <p>5 A. There were a number of errors. For</p> <p>6 instance, his Figure 3 is incorrect. His Figure 3</p> <p>7 shows an arm with a heated-air gap and then inflated</p> <p>8 tube, so the blanket is actually elevated over the</p> <p>9 arm. And that's not how these devices operate. These</p> <p>10 devices operate where the ar -- the blanket wraps</p> <p>11 around the arm and touches the arm. So there is not</p> <p>12 a, the word is coaxial arm and blanket. That doesn't</p> <p>13 occur.</p> <p>14 Q. Okay. Did you identify other errors in this</p> <p>15 Exhibit 15?</p> <p>16 A. I did.</p> <p>17 Q. Okay.</p> <p>18 A. Another error that I identified is with his</p> <p>19 convective heat transfer coefficient which he used,</p> <p>20 and that is seen in equation 3. He's used a value of</p> <p>21 the convective heat transfer coefficient which is</p> <p>22 artificially low, his value is 5. My own research</p> <p>23 shows a value of about 11. So that's a error of a</p> <p>24 factor of two.</p> <p>25 Q. Okay. And I realize you only saw this for</p>	<p style="text-align: right;">Page 352</p> <p>1 Q. Okay. Any other issues with Exhibit 15 that</p> <p>2 you've been able to identify in the last 24 hours?</p> <p>3 A. Yes.</p> <p>4 Q. Okay.</p> <p>5 A. In Figure 5 he has a schematic for heat</p> <p>6 transfer from the air to the body, and he has two</p> <p>7 temperatures listed there which are both in error. He</p> <p>8 lists the body temperature of 37 degrees Celsius; it</p> <p>9 is not, that is too high. He lists the blower air</p> <p>10 temperature at the inlet of 41. And while I recognize</p> <p>11 that these devices operate with different blower</p> <p>12 temperatures, in my opinion this should be the inlet</p> <p>13 temperature to the blanket of 43 Celsius.</p> <p>14 Q. Okay.</p> <p>15 A. And those are the key issues.</p> <p>16 Q. All right. Now on the back of one of those</p> <p>17 pages there are some notations?</p> <p>18 A. Yes.</p> <p>19 Q. All right. Did you make those notations?</p> <p>20 A. Yes, I did.</p> <p>21 Q. And what are those?</p> <p>22 A. Those are written equations called the</p> <p>23 Navier-Stokes equations.</p> <p>24 Q. All right. And why did you write those out?</p> <p>25 A. Because I was anticipating that I would be</p>
<p style="text-align: right;">Page 351</p> <p>1 the first time yesterday, but did you formulate any</p> <p>2 other impressions of potential errors in this</p> <p>3 submission?</p> <p>4 A. Yes.</p> <p>5 Q. Okay.</p> <p>6 A. He describes air supposedly moving around</p> <p>7 the arm from the blanket, and then he says -- he</p> <p>8 calculates an air velocity of .514 meters per second.</p> <p>9 Sitting here right now I don't recall if he ever used</p> <p>10 that number in his report. But what he says next is</p> <p>11 important. He says: "It should be noted that this is</p> <p>12 the velocity before the air reaches the drape that</p> <p>13 covers the blanket. The air will then leave the drape</p> <p>14 edges" at a lower velo -- "at a lower velocity as</p> <p>15 shown in Figure 4." And then he has arrows pointing</p> <p>16 to a red outline of the lower edge of the drape, and I</p> <p>17 believe that that is physically impossible. It is</p> <p>18 impossible for hot air to travel to the arrowed</p> <p>19 locations as he describes.</p> <p>20 Q. And what's the length of the arrow</p> <p>21 locations; does he indicate?</p> <p>22 A. I -- He --</p> <p>23 There's no indication that I see --</p> <p>24 Q. Okay.</p> <p>25 A. -- of the length.</p>	<p style="text-align: right;">Page 353</p> <p>1 asked to write them in the deposition, and out of an</p> <p>2 abundance of caution I reminded myse -- they're very</p> <p>3 complex, so I had to remind myself of all the terms.</p> <p>4 Q. All right.</p> <p>5 MR. GOSS: That's all I have for you, sir.</p> <p>6 EXAMINATION</p> <p>7 BY MR. ASSAAD:</p> <p>8 Q. How did you remind yourself?</p> <p>9 A. I wrote them a number of times over and</p> <p>10 over.</p> <p>11 Q. Were you looking at a book?</p> <p>12 A. No.</p> <p>13 Q. You did it off your memory.</p> <p>14 A. No. I actually put the equations in my</p> <p>15 journal paper, and so I just transcribed them from the</p> <p>16 journal paper.</p> <p>17 Q. Okay. So you didn't just write them off</p> <p>18 your memory, you actually looked at another document</p> <p>19 to write them down.</p> <p>20 A. That is correct.</p> <p>21 Q. And you practiced them because you thought I</p> <p>22 was going to ask you that question today.</p> <p>23 A. I would say I memorized them. There's many</p> <p>24 terms, and I wanted to make sure I had every term</p> <p>25 correct.</p>

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<p style="text-align: right;">Page 354</p> <p>1 Q. Okay. All right. 2 Let's first talk about validation. You 3 listed two papers, Exhibits Number 12 and 11, written 4 by one of the authors of Apte; correct? 5 A. Correct. 6 Q. And you're using this to prove that -- to 7 show that the code is not validated; correct? 8 MR. GOSS: Object to form. 9 Q. That's what my under -- 10 I could be incorrect, but that's what my 11 understanding was. 12 A. Dr. Elghobashi cited a number of references 13 of Elghobashi that he says demonstrated validation. 14 In my mind those articles do not demonstrate 15 validation. 16 Q. So they demonstrate -- 17 So they don't demonstrate validation, in 18 your mind, with regard to Elghobashi's validation; 19 correct? 20 A. Correct. 21 Q. And just -- just to clarify, you've had Dr. 22 Elghobashi's report since March; correct? 23 A. I don't know -- 24 That seems a little early. I don't know 25 when I received it.</p>	<p style="text-align: right;">Page 356</p> <p>1 heard something that I disagreed with. What I heard 2 was that if a code is validated for one case, it could 3 automatically be used for another case provided the 4 ingredients were the same. Now he said that in his 5 deposition. That was not in his expert report. 6 Following that deposition I inquired, was his 7 statement at his deposition correct. 8 So you've asked me a question about a 9 deadline? I'm not aware of the legal deadlines in 10 this case. 11 Q. Okay. You agree that with respect to codes 12 that are written for CFD, such as the one that 13 Elghobashi used, it's always an ongoing process; 14 correct? 15 A. Not necessarily. 16 Q. Well you agree that the Stanford code that 17 was used is maintained and run by Ph.D. students that 18 keep on updating it on a yearly basis, providing new 19 code to solve problems. 20 MR. GOSS: Object to lack of foundation. 21 A. I have no basis to know that. 22 Q. Okay. So you don't know what the current 23 code is -- the current state of the code as of 2017 is 24 of the code that Elghobashi used; correct? 25 A. Correct. The only thing --</p>
<p style="text-align: right;">Page 355</p> <p>1 Q. But you had the -- you had his report that 2 -- report that these two articles are cited prior to 3 submitting your expert report on June 2nd; correct? 4 A. That is correct. 5 Q. And these critiques of validation are being 6 raised for the first time by you today; correct? To 7 at least -- To at least the plaintiffs. 8 A. No. I critiqued him in validation in my 9 expert report. 10 Q. But you did not use these two documents in 11 your critique; correct? 12 A. That is correct. 13 Q. The first time you've raised to the 14 plaintiffs the -- the critique of Elghobashi's 15 validation with respect to these two articles, Exhibit 16 11 and 12, is today; correct? 17 A. Correct. 18 Q. Okay. And you understand that the deadline 19 of June 2nd, 2017 was for the defense to provide 20 rebuttal reports to plaintiffs' expert reports. 21 MR. GOSS: Object to form. He's not a 22 lawyer. 23 You can testify if you have an 24 understanding about that. 25 A. When I went to Elghobashi's deposition I</p>	<p style="text-align: right;">Page 357</p> <p>1 Q. Okay. And -- 2 A. -- I know is -- 3 Q. -- And -- And -- 4 MR. GOSS: Let him finish. We're -- 5 Q. And moving forward, you agree that -- 6 MR. GOSS: Now we're off the clock. He can 7 give a full answer. 8 MR. ASSAAD: Okay. That's fine. 9 A. The only thing that I know is based on the 10 technical information in his report. 11 Q. Okay. And -- And the technical information 12 you look at Exhibit 12, which is dated 2006; correct? 13 A. Say that again. 14 Q. The article's written in 2006; correct? 15 A. It was published in 2006. 16 Q. So it could have been written in 2005. 17 A. That's correct. 18 Q. Okay. So that is approximately 11 years 19 ago; correct? 20 A. Yes. 21 Q. So you don't know what, if any, change in 22 the code occurred between the publication of this 23 paper and the code that Elghobashi used; correct? 24 A. What I know -- 25 Q. "Yes" or "no," sir? "Yes" or "no"?</p>

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<p style="text-align: right;">Page 358</p> <p>1 MR. GOSS: No --</p> <p>2 Q. You don't know what has occurred between</p> <p>3 2006 and 2017 with respect to the code that Dr.</p> <p>4 Elghobashi used; correct?</p> <p>5 MR. GOSS: Time is no longer an issue.</p> <p>6 MR. ASSAAD: I want him to answer my</p> <p>7 question.</p> <p>8 MR. GOSS: You can answer it, and you can</p> <p>9 provide your explanation.</p> <p>10 MR. ASSAAD: That's fine. As long as I get</p> <p>11 a "yes" or a "no," then he could...</p> <p>12 A. Can you ask the question again?</p> <p>13 Q. You don't know what has changed in the code</p> <p>14 between April of 2006, the date of this publication,</p> <p>15 and 2017; isn't that correct?</p> <p>16 A. That is correct.</p> <p>17 Q. Okay.</p> <p>18 A. What I do know is that that's a paper he</p> <p>19 cited as supporting the validation of the code he used</p> <p>20 in this case.</p> <p>21 Q. Okay. And you agree with me that Exhibit</p> <p>22 Number 11, it was published in 2009.</p> <p>23 A. I agree.</p> <p>24 Q. Okay. And you agree with me that you don't</p> <p>25 know any changes in the code that was use -- that was</p>	<p style="text-align: right;">Page 360</p> <p>1 paper it states, because of the infeasibility and</p> <p>2 impracticability of conducting true validation</p> <p>3 experiments on most complex systems, the recommended</p> <p>4 method is to use a building-block approach.</p> <p>5 Do you agree with that?</p> <p>6 A. Yes.</p> <p>7 Q. Okay. And you testified earlier that the</p> <p>8 CFD modeling that was done in this by you and by</p> <p>9 Elghobashi was a complex system; correct?</p> <p>10 A. Yes.</p> <p>11 Q. Okay. And you're an alumnus of the</p> <p>12 University of Minnesota; correct?</p> <p>13 A. Yes.</p> <p>14 Q. You could have went and talked to Krishnan</p> <p>15 Mahesh and got what actually the Stanford code is</p> <p>16 validated for or not; correct?</p> <p>17 MR. GOSS: I'll object to form.</p> <p>18 A. I don't know. I mean, I -- I think</p> <p>19 Elghobashi said it was a proprietary code.</p> <p>20 Q. You understand that the people that work on</p> <p>21 the code from Stanford take it with them and they're</p> <p>22 allowed to use it, just like Elghobashi was allowed to</p> <p>23 use it, as well as other people.</p> <p>24 MR. GOSS: Lack of foundation.</p> <p>25 A. I do not understand that.</p>
<p style="text-align: right;">Page 359</p> <p>1 made between 2009 and 2017 if any changes were made;</p> <p>2 correct?</p> <p>3 A. I have the same answer as the prior question</p> <p>4 you asked, which is, yes, I do not know.</p> <p>5 Q. Okay.</p> <p>6 A. But that was a document cited in his expert</p> <p>7 report.</p> <p>8 Q. But --</p> <p>9 And you agree that you could -- you could</p> <p>10 validate CFD analysis based on the code being</p> <p>11 validated in prior experiments.</p> <p>12 A. Can you ask that -- That's a cumber --</p> <p>13 I'm struggling to understand your question.</p> <p>14 Q. Well you cited to Exhibit 11 and 12 saying</p> <p>15 that you disagree with Dr. Elghobashi validating his</p> <p>16 code on articles 11 and 12; correct?</p> <p>17 A. Correct.</p> <p>18 Q. Okay. Which means that you could validate</p> <p>19 your CFD analysis based on more complex experiments</p> <p>20 made with the same code; correct?</p> <p>21 A. That is possible, but not necessarily true.</p> <p>22 Q. Okay. And you cited a paper written by</p> <p>23 Oberkampf and Trucano. You recall that; correct?</p> <p>24 A. Yes.</p> <p>25 Q. And you would agree with me that in that</p>	<p style="text-align: right;">Page 361</p> <p>1 Q. Okay.</p> <p>2 (Interruption by the reporter.)</p> <p>3 Q. Well you understand there's codes out there</p> <p>4 written by universities that are proprietary; correct?</p> <p>5 A. Yes.</p> <p>6 Q. And that many students or Ph.D.s work on</p> <p>7 that code and refine that code over time.</p> <p>8 A. Yes.</p> <p>9 Q. Okay. And the Stanford code is an example;</p> <p>10 correct?</p> <p>11 A. Yes.</p> <p>12 Q. And actually The University of Minnesota has</p> <p>13 its own code; correct?</p> <p>14 A. Possibly. I don't know.</p> <p>15 Q. You don't know.</p> <p>16 A. Correct.</p> <p>17 Q. Okay. And you still have ties to the</p> <p>18 University of Minnesota; correct?</p> <p>19 A. Define "ties."</p> <p>20 Q. You still have relationships with your --</p> <p>21 with Sparrow; correct?</p> <p>22 A. Yes.</p> <p>23 Q. Okay. St. Thomas doesn't have its own code;</p> <p>24 correct?</p> <p>25 A. St. Thomas uses ANSYS.</p>

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<p style="text-align: right;">Page 362</p> <p>1 Q. Okay. You agree with me that if the code 2 Elghobashi used was validated for more complex systems 3 used in this case, the same type of math -- for the 4 same type of physics and mathematics, that 5 Elghobashi's CFD is validated. 6 MR. GOSS: Object to form. 7 A. I would agree that if it was validated for 8 as complex or more complex of a case of the same 9 nature, then... 10 No, I would not agree. 11 Q. You wouldn't. 12 A. No. 13 Q. Okay. So you disagree with the article that 14 you wrote that I just read to you. 15 A. Say -- 16 Read that statement again. 17 Q. You recall citing this article in your -- in 18 your report. 19 A. Yes. 20 Q. Okay. Have you read this article? 21 A. Yes. 22 MR. GOSS: This is an article that he 23 wrote? 24 MR. ASSAAD: He cited. 25 MR. GOSS: You said he wrote it.</p>	<p style="text-align: right;">Page 364</p> <p>1 You agree with me this is how -- these are 2 how -- these are how verification and validation -- 3 validation issues are viewed in the fluid dynamics 4 community; correct? 5 A. Yes. 6 Q. Okay. Definitely not my community. You 7 agree with that. 8 A. Possibly. 9 Q. Definitely not Peter Goss's community. 10 MR. GOSS: Well that we can stipulate to. 11 Q. Now you agree with me that Elghobashi put 12 down calculations and computations that you were able 13 to observe and critique; correct? For example, 14 Exhibit Number 15. He wrote down his calculations; 15 correct? 16 A. I believe that is from him, and yes, it does 17 show a calculation. 18 Q. So someone such as yourself could look at 19 what he did to calculate what he did and either agree 20 with it or critique it; correct? 21 A. Correct. 22 Q. Okay. And you did not do such a thing with 23 respect to your initial boundaries; correct? 24 A. Incorrect. 25 Q. Please show me the calculations. Please</p>
<p style="text-align: right;">Page 363</p> <p>1 MR. ASSAAD: I said he cited in his report. 2 MR. GOSS: Okay. I thought you said he 3 wrote it. I'm sorry. 4 Q. You've read this entire article? 5 A. Yes. 6 Q. Okay. When's the last time you read this 7 article? 8 A. Awhile ago. I can't -- 9 Q. Okay. 10 A. I can't recall. 11 Q. It's a large article; correct? 12 A. It was heavy reading. 13 Q. Okay. And in the article which you said you 14 agreed with... No. I withdraw that question. 15 Let me go to a different part, if I can find 16 it. 17 By the way, do you agree that this article's 18 authoritative on verification and validation in 19 computational fluid dynamics? 20 A. I don't know what the word "authoritative" 21 means in this context. 22 Q. But you cited it; correct? 23 A. I cited it as a representation of how these 24 issues are viewed in the community. 25 Q. Okay. So this is --</p>	<p style="text-align: right;">Page 365</p> <p>1 show me one addition that you've provided that has a 2 mathematical equation to the plaintiff in this case. 3 A. Well I think that the question's become 4 confused. 5 Q. No, it hasn't become -- 6 If it's confused, I'll re-ask it. 7 MR. GOSS: He may not -- 8 MR. ASSAAD: I'll re-ask it. 9 MR. GOSS: -- understand what you're 10 asking. 11 Q. I'll re-ask it. 12 Elghobashi provided you calculations of how 13 he did things; correct? 14 A. Correct. 15 Q. And there are actual equations; correct? 16 A. Correct. 17 Q. With numbers. 18 A. Correct. 19 Q. With solutions. 20 A. Correct. 21 Q. With heat value coefficients; correct? 22 A. Correct. 23 Q. That you as a -- a -- a person in the field 24 of mechanical engineering can look at it and critique 25 it and determine whether or not it's correct or not;</p>

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<p style="text-align: right;">Page 366</p> <p>1 correct?</p> <p>2 A. Correct.</p> <p>3 Q. And that's what you did in this case. You</p> <p>4 saw what he did and you say, I disagree.</p> <p>5 A. That's right.</p> <p>6 Q. Correct?</p> <p>7 And you did not provide one equation to the</p> <p>8 plaintiffs that we could do the same type of critique</p> <p>9 that you did to Elghobashi; correct?</p> <p>10 MR. GOSS: You mean other than the TRN</p> <p>11 file?</p> <p>12 Q. There's no equations in the TRN file; are</p> <p>13 there?</p> <p>14 A. Well, I mean, the equations are built into</p> <p>15 the software so you can't really separate the</p> <p>16 equations from the software. But here is -- here is</p> <p>17 the issue --</p> <p>18 Q. My question --</p> <p>19 Let me ask it simple, simple. In Exhibit 1,</p> <p>20 2 or any of the exhibits we saw today that were</p> <p>21 produced by you, okay, except for the Elghobashi</p> <p>22 exhibits or any of the citings --</p> <p>23 Let's go back. Exhibit 1 and 2 of your</p> <p>24 report, your CV, as well as your expert report, you</p> <p>25 agree with me that there is not one mathematical</p>	<p style="text-align: right;">Page 368</p> <p>1 Q. Okay. Do you have any experimental or</p> <p>2 scientific equations, besides the fact that you just</p> <p>3 sit here today and say you disagree, to support your</p> <p>4 -- your -- your critique of Figure 3?</p> <p>5 MR. GOSS: Do you have the exhibit in front</p> <p>6 of you?</p> <p>7 MR. ASSAAD: I showed it to him already.</p> <p>8 MR. GOSS: Oh.</p> <p>9 A. Figure 3 shows --</p> <p>10 Q. That wasn't my question. I know what Figure</p> <p>11 3 shows.</p> <p>12 I'm asking you, do you have any mathematical</p> <p>13 equations or calculations or anything to support your</p> <p>14 critique of Figure 3?</p> <p>15 A. Yes.</p> <p>16 Q. Where?</p> <p>17 A. I have direct observation. I have worked on</p> <p>18 these devices for years. The blanket touches the</p> <p>19 skin. There -- The arm is not in a concentric space</p> <p>20 within the blanket. That is not how these devices</p> <p>21 work.</p> <p>22 Q. So your opinion is that the blanket touches</p> <p>23 the skin?</p> <p>24 A. Yes.</p> <p>25 Q. So the blanket would have a significant heat</p>
<p style="text-align: right;">Page 367</p> <p>1 equation that was provided to the plaintiffs in this</p> <p>2 case.</p> <p>3 A. There is no equation.</p> <p>4 Q. So you agree with me. "Yes" or "no"?</p> <p>5 A. I agree with you, --</p> <p>6 Q. Okay.</p> <p>7 A. -- but the information is listed there that</p> <p>8 would allow someone to reproduce the results.</p> <p>9 Q. Okay. You agree with me that there's not</p> <p>10 one mathematical equation in your expert report;</p> <p>11 correct?</p> <p>12 MR. GOSS: I think he -- I think he</p> <p>13 answered that.</p> <p>14 A. I agree, --</p> <p>15 Q. Okay.</p> <p>16 A. - and it's not necessary.</p> <p>17 Q. And you agree with me there's not one number</p> <p>18 or -- like equation that uses numbers to show what you</p> <p>19 did to make any of your assumptions in your expert</p> <p>20 report; correct?</p> <p>21 MR. GOSS: Asked and answered.</p> <p>22 A. I agree, I think I've answered that.</p> <p>23 Q. Okay. You disagree with Figure 3 of Exhibit</p> <p>24 15; correct?</p> <p>25 A. Yes.</p>	<p style="text-align: right;">Page 369</p> <p>1 transfer by conduction from the blanket to the skin;</p> <p>2 correct?</p> <p>3 MR. GOSS: Object to form.</p> <p>4 A. All of the heat is transferred via -- via</p> <p>5 convection.</p> <p>6 Q. Really?</p> <p>7 A. Yes.</p> <p>8 Q. Would you -- I mean, your critique is that</p> <p>9 -- Strike that.</p> <p>10 Do you not think that the -- the blanket</p> <p>11 itself, the -- that's not the pores heats up?</p> <p>12 A. I do believe the pores heat up.</p> <p>13 Q. So if it's touching the skin, you don't</p> <p>14 think it transfers heat by conduction?</p> <p>15 A. How did the heat get there in the first</p> <p>16 place? All of the heat that is transferred from the</p> <p>17 heater to the patient is by convection. Absolutely.</p> <p>18 Q. You'd bet your career on that, that all the</p> <p>19 heat is transferred from the Bair Hugger by convection</p> <p>20 to the patient? You willing to bet your career on</p> <p>21 that?</p> <p>22 MR. GOSS: I think you're talking about two</p> <p>23 different things.</p> <p>24 MR. ASSAAD: No. He knows exactly what I'm</p> <p>25 talking about.</p>

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<p style="text-align: right;">Page 370</p> <p>1 MR. GOSS: That's argumentative. 2 I think we covered this earlier, but if you 3 have a different answer, you can provide it. 4 A. I would -- 5 MR. GOSS: If you don't, you can stand by 6 your testimony. 7 A. I would never bet my career on the word 8 "all." But here's what I'll say. This device is 9 designed and operated in a way where air is heated up, 10 that air is blown into an inflatable blanket, and that 11 air oozes out of the pores against the skin. That 12 transfer of heat from the heater within the Bair 13 Hugger base to the body is convection. 14 Q. You sure about that? 15 A. Yes. 16 Q. So you're telling me engineering principles 17 of heat transfer that -- 18 I mean you agree with me that you could heat 19 something by convection -- I could heat this paper 20 with a hot air blower by convection; correct? 21 [Demonstrating.] 22 A. Correct. 23 Q. And this paper is going to warm up; correct? 24 A. Yes. 25 Q. Okay. And if I take this paper and put this</p>	<p style="text-align: right;">Page 372</p> <p>1 conduction. 2 A. Through an impermeable surface, the transfer 3 across the surface is by conduction. The transfer to 4 the object initially is convection. 5 Q. Okay. You agree with me that the -- the 6 only way air escapes out of the Bair Hugger is through 7 the pores. 8 A. No. 9 Q. How else would it escape? 10 A. Because when the hose connects with the 11 blanket there may be imperfections in that connection, 12 but I would say this. The majority of the air escapes 13 through the holes. 14 Q. Okay. 15 A. And that air impinges on the skin, and that 16 is a convective heat transfer process. 17 Q. Okay. What about the part where the plastic 18 -- or the Bair Hugger bottom layer is heated? Not 19 where the pores are, but the space in between the 20 pores, okay? If that touches the patient, you agree 21 that the heat transfer from that plastic Bair Hugger 22 layer to the patient where there's contact is 23 conduction. 24 A. I would agree that the heat transfer across 25 the plastic is conduction, but the origination of the</p>
<p style="text-align: right;">Page 371</p> <p>1 pen to it, okay, how's the paper warming up the pen; 2 by convection or by conduction? 3 A. In that case it's a two-step process. The 4 ultimate heat transfer is by convection, and it passes 5 through the paper by conduction. 6 Q. And then it passes to the pen by conduction; 7 correct? 8 A. Well once it's into the pen there's no issue 9 of conduction. 10 Q. You said it passes into the paper by 11 conduction; correct? 12 A. No. No. It pa -- If I said that, it was a 13 mistake. 14 Q. Okay. It passes -- 15 It heats up the paper by convection; 16 correct? 17 A. Yes. 18 Q. And then the paper passes heat -- or 19 transfers heat to the pen that's touching it by 20 conduction; correct? 21 A. If there is contact, the heat is transferred 22 through a wall by conduction. 23 Q. Okay. Okay. So the transfer of heat from 24 the piece of paper to the pen in this example -- I'm 25 going to put it in front of the camera -- is by</p>	<p style="text-align: right;">Page 373</p> <p>1 heat is by convection. 2 Q. I understand that. 3 I think you and I are speaking two different 4 things, because you could heat by convection, but then 5 it's going to warm objects that might transfer heat by 6 conduction; correct? 7 Even though the initial source -- 8 A. The convective heat is transferred through 9 -- could be transferred through the wall by 10 conduction. 11 Q. Okay. 12 A. I would say that. 13 Q. So if the Bair Hugger is -- the plastic, not 14 the -- where the jets are, but the non-jet areas or 15 perforations are touching the patient, there is going 16 to be heat transfer from that solid Bair Hugger wall 17 to the patient. 18 MR. GOSS: Objection, I think it 19 mischaracterizes the Bair Hugger. 20 But if you understand it, you can testify 21 to it. 22 A. Can you ask the question again? 23 (Discussion off the stenographic record.) 24 MR. GOSS: It's not a solid wall. 25 Q. You're assuming that the Bair Hugger is</p>

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<p style="text-align: right;">Page 374</p> <p>1 touching the patient; correct? And that's why you 2 critique Figure 3. 3 A. The critique I have of Figure 3 is that it 4 describes a situation which doesn't exist. That is, 5 it's got a solid arm centrally located, and I think I 6 may have used the word, like, axisymmetrically 7 something located within a circle that is the blanket. 8 And that's not how this thing works, and that's not 9 how it operates. 10 So what he's done here is he's imagined 11 long, straight, rectangular slots through which the 12 air ejects downwards, and that is not how these 13 devices operate. 14 Q. Well you agree that the air is ejected 15 downwards; correct? 16 A. No. 17 Q. Where is the Bair Hugger air blowing? 18 A. Against the skin. 19 Q. Okay. Hypothetically speaking I am four 20 feet tall and I stretch out my hands and the Bair 21 Hugger goes past the end of my hand, the air over -- 22 in that area that goes past my hand, is that ejecting 23 down? 24 A. That -- 25 I mean, that's a hypothetical. From my</p>	<p style="text-align: right;">Page 376</p> <p>1 temperature of 37 degrees Celsius; correct? 2 A. I disagree that that's the skin temperature. 3 Q. Okay. What would you put here as the skin 4 temperature? 5 A. The skin temperature depends on the 6 environment, but a good estimate would be about 35 7 degrees. 8 Q. So you're saying that -- 9 A. Maybe 36. 10 Q. 36 degrees? Okay. 11 A. 35 or 36. 12 Q. Okay. Let's just assume it's 35 degrees. 13 How much would that change his calculations 14 by? 15 A. I did not put corrected numbers in to test 16 that. 17 Q. Okay. So it might only change it 18 insignificantly; correct? 19 A. No. 20 MR. GOSS: Calls for speculation. 21 Q. Well we've talked that -- 22 You don't know how much it would change? 23 A. No. Let me see this. Let me -- 24 Q. Why don't you calculate for me how much it 25 would change?</p>
<p style="text-align: right;">Page 375</p> <p>1 understanding of operating room tables, that air would 2 be ejected against... I don't know. I'd have to see 3 it. I'd have -- I don't know. 4 Q. So sitting here today, you don't know. 5 A. Correct. 6 Q. Okay. And how wide is the -- is the arm 7 where the -- where the arm extension is, like the arm 8 pad and board; do you know? 9 A. I do not know. 10 Q. Okay. And what's the -- the dimensions of 11 the Bair Hugger Blanket 522? 12 A. I don't know the numbers off the top of my 13 head. 14 Q. Have you seen one? 15 A. Yes. 16 Q. Have you measured one? 17 A. I don't recall measuring the physical 18 dimensions of one. 19 Q. Have you received the schematics of one? 20 A. Not that I recall. 21 Q. Do you disagree with the measurements that 22 Elghobashi put in Figure -- Figure 1 with respect to 23 the dimensions? 24 A. I have no reason to disagree. 25 Q. Okay. You disagree with the body</p>	<p style="text-align: right;">Page 377</p> <p>1 MR. GOSS: He's had this for a day. I 2 don't think -- 3 MR. ASSAAD: If he's going to critique it 4 and every little bit, I want to know -- 5 MR. GOSS: He's going to offer additional 6 critiques, because he's only had this for a day, but 7 he can -- he can -- he can do his best to respond to 8 your questions. 9 MR. ASSAAD: Would you agree -- 10 Would you want to just reconvene this 11 deposition, then, so he has time to critique it? 12 A. No. I can critique it now. 13 Q. Okay. 14 A. So let's take the air temperature which he 15 has as 41, and I think a more appropriate number would 16 be 43. 17 (Witness starting to mark an exhibit.) 18 A. Actually let me just -- Let's put forty -- 19 (Interruption by the reporter.) 20 (Discussion off the stenographic record.) 21 A. Let me just do it in my mind. 22 So he's using 41 minus 37, that's a 23 temperature difference of four degrees. I think a 24 more accurate set of numbers would be 43 to 35, which 25 is eight degrees, so that's a factor of two. He also</p>

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<p style="text-align: right;">Page 378</p> <p>1 is off by --</p> <p>2 Q. Before I finish. When -- Is "T" in the</p> <p>3 equations Celsius or Kelvin?</p> <p>4 A. Celsius.</p> <p>5 Q. Okay.</p> <p>6 A. He's off by a factor of two in his "h"</p> <p>7 value, so that's --</p> <p>8 Q. I'm just talking about the temperature now.</p> <p>9 A. You just want me to --</p> <p>10 Q. If you changed the temperature to what you</p> <p>11 thought it would be, how much would it affect the</p> <p>12 results of his -- of his tem --</p> <p>13 A. One hundred percent.</p> <p>14 Q. One hundred --</p> <p>15 A. He would be off by a hundred percent.</p> <p>16 Q. Okay. And you -- you think the temperature</p> <p>17 coming out of the Bair Hugger, the air is 43 degrees</p> <p>18 Celsius?</p> <p>19 A. Well that would be the maximum temperature.</p> <p>20 It's my understanding that's the maximum temperature</p> <p>21 of the air entering the Bair Hugger.</p> <p>22 MR. GOSS: Blanket; correct?</p> <p>23 THE WITNESS: Blanket.</p> <p>24 Q. Well he's talking about the Bair -- air</p> <p>25 coming out of the Bair Hugger, and in the gap between</p>	<p style="text-align: right;">Page 380</p> <p>1 Q. Okay.</p> <p>2 A. But that still doesn't correct his</p> <p>3 temperature-drop calculations.</p> <p>4 Q. Okay. Well the other critique is he put 37,</p> <p>5 and you might think it's 35 or 36; correct?</p> <p>6 A. Correct. And the "h" value.</p> <p>7 Q. Okay. Not there yet.</p> <p>8 You said he had an "h" value of 5; correct?</p> <p>9 A. Correct.</p> <p>10 Q. Do you disagree with the reference he used</p> <p>11 to determine his "h" value?</p> <p>12 A. Can you remind me that reference?</p> <p>13 Q. R. J. De Dear, E. Arens, titled -- a couple</p> <p>14 of authors -- titled "Convective and Radiative Heat</p> <p>15 Transfer Coefficients For Individual Human Body</p> <p>16 Segments."</p> <p>17 A. That paper --</p> <p>18 So I've actually done research on convective</p> <p>19 coefficients between forced-air warming blankets and</p> <p>20 bodies, and the values that we calculated were 10 to</p> <p>21 11. Now that reference I don't believe pertains to</p> <p>22 forced-air warming blankets.</p> <p>23 If I read that document -- See it doesn't</p> <p>24 mention anything in the title about forced-air warming</p> <p>25 blankets. If I read that document and I find that it</p>
<p style="text-align: right;">Page 379</p> <p>1 the Bair Hugger blanket and the surface of the body.</p> <p>2 So your testimony today is that air coming</p> <p>3 out of the Bair Hugger is 43 degrees Celsius?</p> <p>4 A. No.</p> <p>5 Q. You used 41 degrees; correct?</p> <p>6 A. I did, but you're mixing what he's done and</p> <p>7 -- You're mixing things up.</p> <p>8 Q. He put down the blower air, then the gap</p> <p>9 between the blanket surface and the body, and then the</p> <p>10 exit temperature; correct?</p> <p>11 A. Yes. He put that down.</p> <p>12 Q. Okay. So if he's referring to the air</p> <p>13 coming out of the blanket, you would have no critique</p> <p>14 of the 41 degrees Celsius temperature.</p> <p>15 That's what you used.</p> <p>16 A. Well it's hard to answer because...</p> <p>17 I mean, you might be right. You might be</p> <p>18 right. Let me think about this.</p> <p>19 The air entering the blanket is 43, so some</p> <p>20 of the air comes out at forty -- some of the air is</p> <p>21 coming out hotter, some of it's coming out colder.</p> <p>22 Okay. So if what he has done is assume that all the</p> <p>23 air comes out at 41, then I take that criticism back.</p> <p>24 That would be an average. That would be an</p> <p>25 appropriate upper bound average.</p>	<p style="text-align: right;">Page 381</p> <p>1 is related to forced-air warming blankets then I would</p> <p>2 revise my criticism, but I don't believe it is. I</p> <p>3 think he used an inappropriate value that's off by a</p> <p>4 hundred percent.</p> <p>5 Q. Okay. And where would I find your value of</p> <p>6 11?</p> <p>7 A. In my CV. I've got a journal paper</p> <p>8 published -- I think it's called Whole Body Warming</p> <p>9 Hypothermia something, but it's there.</p> <p>10 Q. Is that the one with Vallez and Plourde,</p> <p>11 Plourde?</p> <p>12 A. I --</p> <p>13 No, it's not that one that we're talking</p> <p>14 about. It's a different paper.</p> <p>15 Q. Okay. Who funded that research?</p> <p>16 A. That was funded by Smiths Medical.</p> <p>17 Q. Okay. Now go to Belani, and...</p> <p>18 You're not critiquing Dr. Elghobashi for the</p> <p>19 fact that he wrote down all his equations and</p> <p>20 assumptions; are you?</p> <p>21 A. No.</p> <p>22 Q. Okay. I mean, you agree that significant</p> <p>23 assumptions should be provided in a expert report or</p> <p>24 publication; correct?</p> <p>25 MR GOSS: We're getting beyond the scope of</p>

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<p style="text-align: right;">Page 382</p> <p>1 my redirect, but you can answer that.</p> <p>2 A. I do agree significant assumptions --</p> <p>3 Q. Okay.</p> <p>4 A. -- should be listed.</p> <p>5 Q. So you cite to McGovern with respect to</p> <p>6 their bubble tests; correct? That they put the bubble</p> <p>7 testing at the -- at the front of the anesthesia drape</p> <p>8 --</p> <p>9 THE REPORTER: They put the bubble testing?</p> <p>10 Q. -- at the head, at the -- in the front of</p> <p>11 the anesthesia drape where the head is; correct?</p> <p>12 A. Correct.</p> <p>13 Q. Okay. And you believe that's the correct</p> <p>14 way of --</p> <p>15 You believe they did that because you think</p> <p>16 they felt that that's where the excess air was coming;</p> <p>17 correct?</p> <p>18 MR. GOSS: Lack of foundation.</p> <p>19 A. I can only --</p> <p>20 I mean, I don't know what they were</p> <p>21 thinking, I only know what's in their report, and</p> <p>22 what's in their report contradicts Dr. Elghobashi.</p> <p>23 Q. Are you aware that Dr. McGovern, Albrecht,</p> <p>24 Dr. Belani, Nachtsheim and Reed were all deposed in</p> <p>25 this case?</p>	<p style="text-align: right;">Page 384</p> <p>1 testimony or their depositions in your expert report;</p> <p>2 correct?</p> <p>3 A. That is correct.</p> <p>4 Q. Or in Exhibit C, which was documents you</p> <p>5 considered that were outside of your expert report;</p> <p>6 correct?</p> <p>7 A. Boy, I'd have to check. Do we have Exhibit</p> <p>8 3?</p> <p>9 Q. Right there. Exhibit 3.</p> <p>10 A. Those depositions are not cited here.</p> <p>11 Q. Okay. Do you consider the report by Dr.</p> <p>12 McGovern, which is Exhibit 13, reliable?</p> <p>13 A. No.</p> <p>14 Q. Were you --</p> <p>15 Did you find this report independently, or</p> <p>16 was it given to you by counsel?</p> <p>17 A. I don't recall. I was given a number of</p> <p>18 documents and then I performed my own literature</p> <p>19 search. I don't recall using any of the documents</p> <p>20 given to me by counsel.</p> <p>21 Q. So you found this document on your own then;</p> <p>22 correct?</p> <p>23 A. I believe I did, but I don't know for sure.</p> <p>24 Q. What search terms did you use?</p> <p>25 A. Oh man. I may have used laminar flow,</p>
<p style="text-align: right;">Page 383</p> <p>1 A. I am aware McGovern and Albrecht were</p> <p>2 deposed. I don't know if any others.</p> <p>3 Q. Have you read their depositions?</p> <p>4 A. Yes.</p> <p>5 Q. I asked you before whether or not you read</p> <p>6 any fact witness depositions and you said you haven't</p> <p>7 read any since December of 2015. Do you recall that?</p> <p>8 A. Yeah. Maybe I thought they were expert</p> <p>9 witnesses. I don't -- I may have -- I may have made</p> <p>10 an error, but I certainly read them. I thought I told</p> <p>11 you that. And if I didn't, I apologize.</p> <p>12 Q. And I've also asked you what expert</p> <p>13 depositions you've read and you did not mention these</p> <p>14 people at all either; did you?</p> <p>15 A. I don't know if that's true.</p> <p>16 Q. Well you --</p> <p>17 MR. GOSS: So if you want to ask him about</p> <p>18 that testimony, you have an opportunity to.</p> <p>19 Q. Did you have that testimony prior to</p> <p>20 providing -- doing your report in this case?</p> <p>21 A. No.</p> <p>22 Q. So you got it after you submitted your</p> <p>23 report?</p> <p>24 A. Correct.</p> <p>25 Q. And you didn't cite to any of their</p>	<p style="text-align: right;">Page 385</p> <p>1 operating room, forced-air warming. I don't recall</p> <p>2 the search terms I used.</p> <p>3 Q. Would the same apply to the Belani article</p> <p>4 marked Exhibit 14?</p> <p>5 A. Same answer.</p> <p>6 Q. So I assume you pulled up more than these</p> <p>7 two articles; correct?</p> <p>8 A. What do you mean by "pulled up"?</p> <p>9 Q. Like you did some independent research and</p> <p>10 provided -- you found articles on the Bair Hugger</p> <p>11 which you cited in your references, and Exhibit C, if</p> <p>12 there are any -- or Exhibit 3, I'm sorry, and these</p> <p>13 two articles; correct?</p> <p>14 A. Well there's many articles, but I think</p> <p>15 those articles are actually in my expert report.</p> <p>16 Q. Okay. Okay. Do you agree with me that,</p> <p>17 with respect to Exhibit 15, that the equations that</p> <p>18 Dr. Elghobashi used are the correct equations?</p> <p>19 A. Can you point out which equations you're</p> <p>20 referring to?</p> <p>21 Q. The equations on top of page 2 where he</p> <p>22 calculates the volumetric flow rate over the gap area?</p> <p>23 A. The mathematics is done correctly, but this</p> <p>24 equation represents something that doesn't happen</p> <p>25 physically, so it's a meaningless equation.</p>

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<p style="text-align: right;">Page 386</p> <p>1 Q. Okay. But the equation is a correct equa --</p> <p>2 the mathematics are correct, you don't think the</p> <p>3 equation itself is correct.</p> <p>4 A. Just doing it in my head it appears the</p> <p>5 numbers work out. So the left -- the right-hand side</p> <p>6 is obtained when you put the left-hand side numbers</p> <p>7 in.</p> <p>8 Q. Okay. Maybe the better question is this:</p> <p>9 Assuming that Figure 3 is correct, okay, and based off</p> <p>10 Figure 3 you want to calculate the velocity of the</p> <p>11 flow coming out, is the equation correct to use that</p> <p>12 veloci -- to calculate that velocity, if Figure 3 is</p> <p>13 correct?</p> <p>14 MR. GOSS: Object to form.</p> <p>15 A. No.</p> <p>16 Q. What's wrong with it?</p> <p>17 How would you calculate the velocity of the</p> <p>18 air coming out of the Bair Hugger over that area?</p> <p>19 A. What he has ignored, eve --</p> <p>20 Q. I'm asking how you would calculate it.</p> <p>21 A. I would calculate it differently.</p> <p>22 Q. How would you calculate it?</p> <p>23 A. I'm going to tell you.</p> <p>24 Q. Please do.</p> <p>25 A. I would cal -- I do not believe --</p>	<p style="text-align: right;">Page 388</p> <p>1 Q. Do you think the number of holes in a Bair</p> <p>2 Hugger is a constant from blanket to blanket?</p> <p>3 A. No.</p> <p>4 Q. Okay. So you'd have to physically cou --</p> <p>5 you'd have to physically take a Bair Hugger blanket</p> <p>6 and count how many holes to get the correct velocity</p> <p>7 for that particular blanket; correct?</p> <p>8 A. If you want to know the jet velocity coming</p> <p>9 out of the Bair Hugger then that is certainly one way.</p> <p>10 That's how I would do it.</p> <p>11 Q. Okay. Do you agree with the equation of 1.2</p> <p>12 with respect to the exit air temperature? The m in, h</p> <p>13 in?</p> <p>14 A. I have no argument about --</p> <p>15 I have no disagreement with that equation.</p> <p>16 Q. What about with the equation below it with</p> <p>17 the h in equals h exit plus q body, divided by m?</p> <p>18 A. I have no disagreement with that equation.</p> <p>19 Q. Okay. So basically on those two equations</p> <p>20 you would agree with me that Elghobashi understands</p> <p>21 the basic laws of physics; correct?</p> <p>22 MR. GOSS: Object to form. I also think in</p> <p>23 redirect he made clear what his criticisms are. Now</p> <p>24 you're asking him beyond -- questions beyond that.</p> <p>25 If you can answer the question, you may.</p>
<p style="text-align: right;">Page 387</p> <p>1 Q. Actually, let's write it down.</p> <p>2 MR. GOSS: Hold on.</p> <p>3 Q. Let's -- Write it down.</p> <p>4 MR. GOSS: Hold on. Let him answer.</p> <p>5 MR. ASSAAD: Okay.</p> <p>6 MR. GOSS: He's not going to obey your</p> <p>7 command to write anything. Let him answer the</p> <p>8 question.</p> <p>9 Q. Feel free to write it down if you know how.</p> <p>10 MR. GOSS: Object. Move to strike.</p> <p>11 A. And can you tell me the question again, the</p> <p>12 specific --</p> <p>13 Q. What equation would you use to calculate the</p> <p>14 velocity of the air coming out of the Bair Hugger</p> <p>15 assuming that Figure 3 is correct?</p> <p>16 Do you need a pen?</p> <p>17 A. Hold on. The velocity of the air coming out</p> <p>18 of the Bair Hugger?</p> <p>19 Q. Yes. Blanket. Blanket.</p> <p>20 A. The equation that I would use is I would</p> <p>21 take the number of holes, multiplied by the area of</p> <p>22 the holes, and that would be the total jet area, and</p> <p>23 then I would take the flow rate divided by that area.</p> <p>24 That's how I'd get the velocity of the air emerging</p> <p>25 from the Bair Hugger.</p>	<p style="text-align: right;">Page 389</p> <p>1 A. Those two equations are the first law of</p> <p>2 thermodynamics, which governs energy conservation. I</p> <p>3 believe he has written those correctly.</p> <p>4 Q. I mean, but you stated in your report that</p> <p>5 he didn't understand the basic laws of physics. Well</p> <p>6 with respect to these equations do they indicate or</p> <p>7 not indicate that he knows the basic laws of physics?</p> <p>8 MR. GOSS: Objection to form. This is</p> <p>9 becoming counterproductive.</p> <p>10 I don't think you have to answer that. I</p> <p>11 think you already have.</p> <p>12 Q. Did you put in --</p> <p>13 MR. GOSS: And you said --</p> <p>14 Q. Did you put in your report that Elghobashi</p> <p>15 doesn't understand the basic laws of physics?</p> <p>16 A. I may have, and I believe he --</p> <p>17 I think you're confusing two things. I --</p> <p>18 What we're talking about here is a simple</p> <p>19 conservation-of-energy equation which I think he's</p> <p>20 written correctly, but that -- my arguments in his</p> <p>21 expert report go beyond a simple</p> <p>22 conservation-of-energy equation.</p> <p>23 Q. Okay. So you agree with me here that except</p> <p>24 for the one equation that you think you do different,</p> <p>25 which is the velocity -- the velocity of the air</p>

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<p style="text-align: right;">Page 390</p> <p>1 coming out of the Bair Hugger, that all the other 2 equations he used to calculate whatever he was 3 calculating are correct? 4 A. Well I would argue the entire premise of his 5 calculation is incorrect. 6 Q. Assuming Figure 3 is correct. The equations 7 are correct. You're not disagreeing with the 8 equations that he used. 9 MR. GOSS: Objection, mischaracterizes his 10 testimony with respect to one of the equations. 11 A. I think equation 4 is incorrect. 12 Q. "Incorrect"? 13 A. Right. 14 Q. Okay. 15 A. I think he's used the wrong value of the 16 convective coefficient. 17 Q. Well forget about the values used. I'm 18 talking about the actual mathematical equation. 19 A. Actually he's got another maybe more serious 20 error. In equation 3 he has the heat transfer to the 21 body and he's got an "h" value times an area of the 22 blanket surface. That's not correct. That should be 23 the area of the body. So he's got the wrong area -- 24 Q. Okay. 25 A. -- in equation 3.</p>	<p style="text-align: right;">Page 392</p> <p>1 each other all the time. 2 Q. Would you expect someone such as your 3 professor, Dr. Sparrow, to criticize someone of the 4 stature of Elghobashi the way you did by saying he 5 doesn't know the basic laws of physics? 6 MR. GOSS: Same objection. I'm also going 7 to object that this doesn't have anything to do with 8 the actual scientific opinions rendered in his report 9 or the scientific issues subject to expert testimony 10 in this case. I also think it was asked and 11 answered. 12 MR. ASSAAD: What Dr. Sparrow would do? 13 MR. GOSS: All right. You can answer if 14 you have an understanding of what Dr. Sparrow thinks 15 and what he would do. 16 A. I don't know what Dr. Sparrow would do. 17 MR. ASSAAD: Well first of all I'm going to 18 object to his -- any of his opinions that he gives 19 outside his expert report as rebuttal under Rule 16 20 and Rule 26 and the Court's PTO order that governs 21 discovery in this case. This is untimely, especially 22 with some of the documents that he had in his 23 possession. I think he had everything in his 24 possession prior to the deposition of Dr. Elghobashi. 25 Furthermore, these are new opinions that</p>
<p style="text-align: right;">Page 391</p> <p>1 I did not look up his enthalpy values, so I 2 can't comment on whether they're correct or not. 3 Q. Okay. 4 (Interruption by the reporter.) 5 Q. Do you believe it is professional to call a 6 professor or a scientist in the community that has 7 been working 30 to 40 years doing engineering research 8 and has published probably more than you, that that 9 person doesn't understand the basic laws of physics? 10 MR. GOSS: All right. You had the 11 opportunity to ask that question during seven hours 12 of direct exam. This does not relate to my redirect. 13 MR. ASSAAD: It goes to him doing these 14 calculations and criticizing his calculations. 15 MR. GOSS: Okay. I'm going to object to 16 form on multiple grounds. 17 MR. ASSAAD: That's fine. 18 MR. GOSS: If you understand the question, 19 then you can provide an answer. 20 A. I -- I'm not sure he has published more than 21 me, but that's immaterial. 22 I think he has made some serious errors. I 23 think he does not -- did not account for the buoyancy 24 of the air in the OR, and I think that's a serious 25 error. And so critici -- Look, scientists criticize</p>	<p style="text-align: right;">Page 393</p> <p>1 the court has specifically refused and that the 2 defense had a time to offer rebuttal. Well the Court 3 definitely has refused surrebuttal. The expert 4 time -- deadline to provide rebuttal opinions was 5 June 2nd, and this should have been disclosed prior 6 to then. 7 MR. GOSS: And we will stipulate that Dr. 8 Elghobashi's supplemental report is untimely. 9 Subject to that, I disagree with what you said, 10 -- 11 MR. ASSAAD: I haven't -- 12 MR. GOSS: -- respectfully. 13 MR. ASSAAD: I haven't finished yet. 14 MR. GOSS: You may finish. You may finish. 15 MR. ASSAAD: And just for the record, this 16 is not a supplemental report, this was added to his 17 errata sheet in response to a question. 18 MR. GOSS: You call it what you will. 19 MR. ASSAAD: Okay. I lost my track or 20 line, Peter. It's been a long day. 21 Anyway, we're just going to object, a 22 formal objection, and we're going to leave this 23 deposition open for me to seek more documents 24 possibly, and files that were clearly not produced 25 today that were clearly in the possession of Dr.</p>

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<div style="text-align: right;">Page 394</div> <p>1 Abraham and may have been in the possession of 3M, 2 and we will address the other issues -- these issues 3 with the court. 4 MR. GOSS: And I'll just state that we 5 believe we have complied, but we understand your 6 position. 7 MR. ASSAAD: That's it. 8 MR. GOSS: I don't have any further 9 questions. 10 THE REPORTER: Off the record. 11 (Deposition adjourned at 7:33 p.m.) 12 13 14 15 16 17 18 19 20 21 22 23 24 25</p>	<div style="text-align: right;">Page 396</div> <p>1 SIGNATURE PAGE 2 I, JOHN P. ABRAHAM, Ph.D., the deponent, hereby 3 certify that I have read the foregoing transcript, 4 consisting of 394 pages, and that said transcript is 5 a true and correct, full and complete transcription 6 of my deposition, except per the attached 7 corrections, if any. 8 PAGE LINE CHANGE/REASON FOR CHANGE 9 _____ 10 _____ 11 _____ 12 _____ 13 _____ 14 _____ 15 _____ 16 _____ 17 _____ 18 _____ 19 _____ 20 Date Signature of Witness 21 _____ 22 WITNESS MY HAND AND SEAL this _____ 23 day of _____, 2017. 24 _____ 25 (DJC) _____</p>
<div style="text-align: right;">Page 395</div> <p>1 CERTIFICATE 2 I, Debby J. Campeau, hereby certify that I 3 am qualified as a verbatim shorthand reporter; that I 4 took in stenographic shorthand the testimony of JOHN 5 P. ABRAHAM, Ph.D. at the time and place aforesaid; 6 and that the foregoing transcript consisting of 394 7 pages is a true and correct, full and complete 8 transcription of said shorthand notes, to the best of 9 my ability. 10 Dated at Lino Lakes, Minnesota, this 24th 11 day of July, 2017. 12 13 14 15 DEBBY J. CAMPEAU 16 Notary Public 17 18 19 20 21 22 23 24 25</p>	<div style="text-align: right;">Page 396</div>